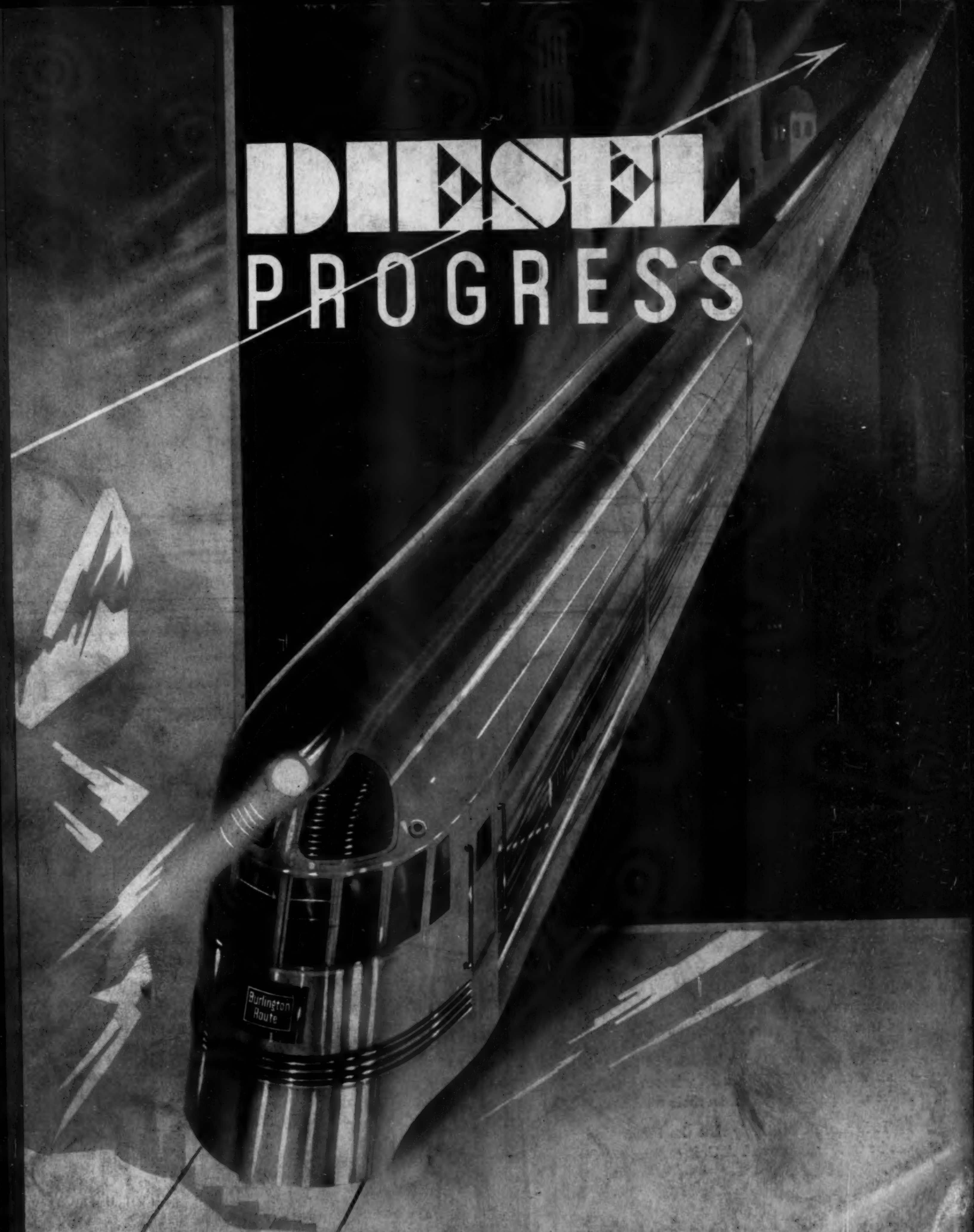
DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



DECEMBER, 1936 . CIRCULATION OF THIS ISSUE—IN EXCESS OF 11,000 COPIES 25c

DIESEL PROGRESS for December, 1936. Volume II, No. 12. DIESEL PROGRESS published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Pan American countries $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U.S.A., 50 cents for all other countries.

ANNOUNCEMENT

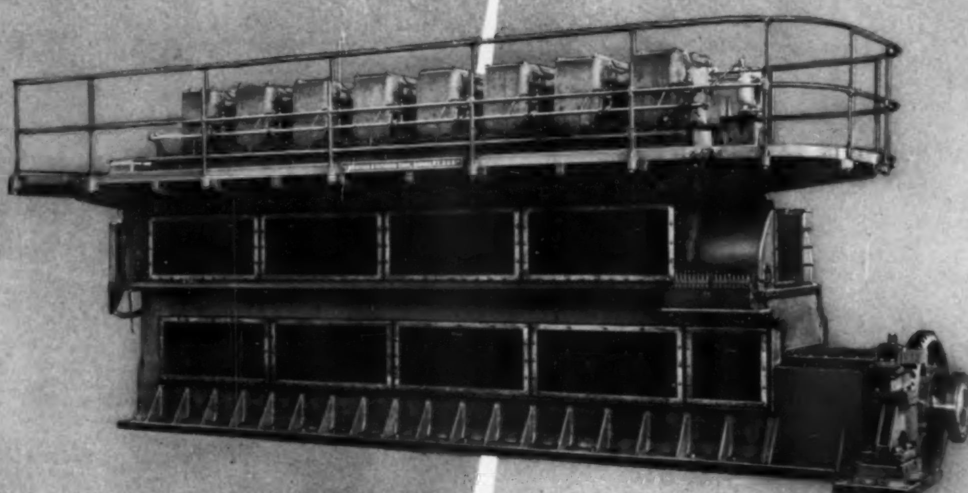
★

In addition to the outstanding line of Diesel engines which the NORDBERG MANUFACTURING COMPANY of Milwaukee, Wisconsin, is building, this Company now has the distinction of announcing its license for building BURMEISTER & WAIN two-cycle engines in the United States in single and double acting types for both marine and stationary service. This combination of BURMEISTER & WAIN and NORDBERG, brings to users of Diesel engines, the tried and proved designs of one of the foremost builders of marine and stationary engines in Europe, and the experience and facilities of NORDBERG, one of the oldest builders of Diesels in America.

★

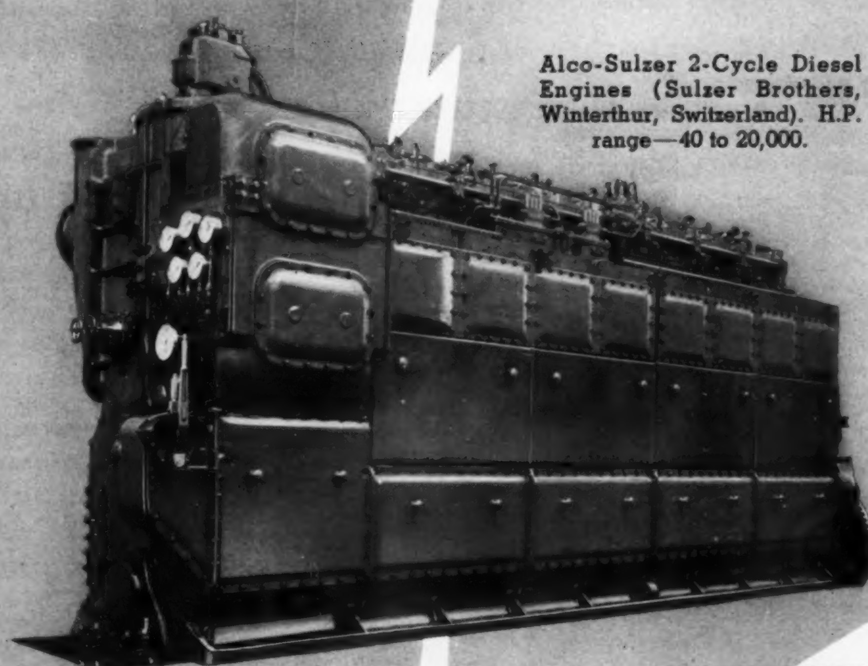
NORDBERG MFG. COMPANY
MILWAUKEE, WISCONSIN

MODERN DIESEL



McIntosh & Seymour 4-Cycle Diesel Engines. H.P. range—80 to 8,000.

Alco-Sulzer 2-Cycle Diesel Engines (Sulzer Brothers, Winterthur, Switzerland). H.P. range—40 to 20,000.



ALCO

POWER

THE name under which a product is made and marketed plays an important part for good or ill in the growth of the institution behind it.

If it represents the energizing force of endeavor, if it symbolizes progress, it becomes a criterion of excellence by which all others in its field are judged.

Therefore, a good name must always be safeguarded. Its owner is inseparately associated with his product for the name indicates the purpose of one and the quality of the other, which forbids a lower standard of either when confidence once is gained. Such a name is ALCO.

Alco products express the character of the builder in the delivery of quality and performance to the buyer. They reflect the aim of a personnel whose unfailing devotion to the cause of service ranks first.

McIntosh & Seymour four-cycle Diesel designs, and Alco-Sulzer two-cycle Diesel designs are products of ALCO. They and their builder are inseparately associated. Through their sustained operating economy, convenience, dependability and long life, they have earned the distinction of delivering the utmost in trustworthiness.

AMERICAN LOCOMOTIVE COMPANY

DIESEL ENGINE DIVISION

OFFICE AND WORKS, AUBURN, N. Y.

NEW YORK, N. Y., 30 Church St. BOSTON, MASS., 20 Newbury St. CHICAGO, ILL., McCormick Bldg. WASHINGTON, D. C., Barr Bldg.
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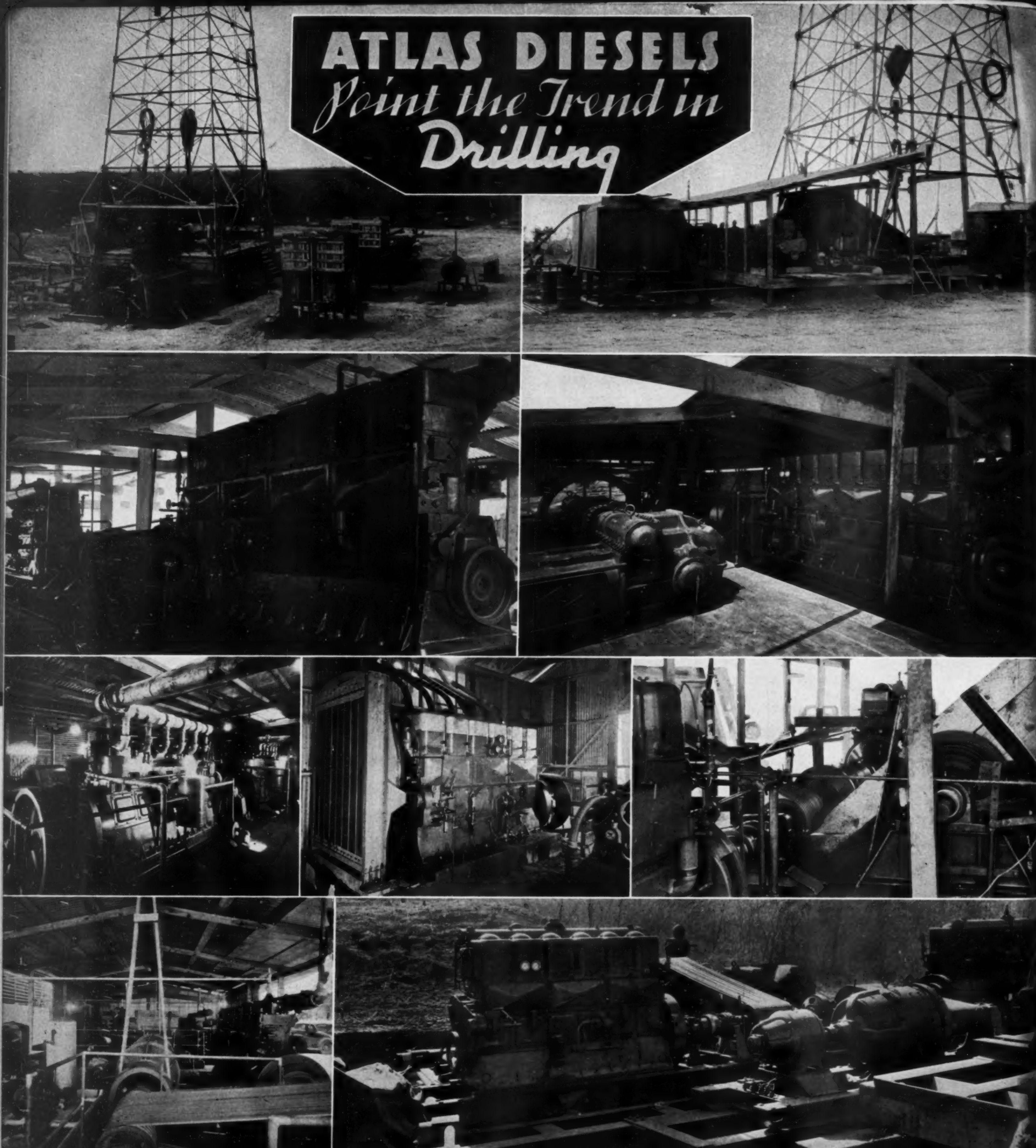
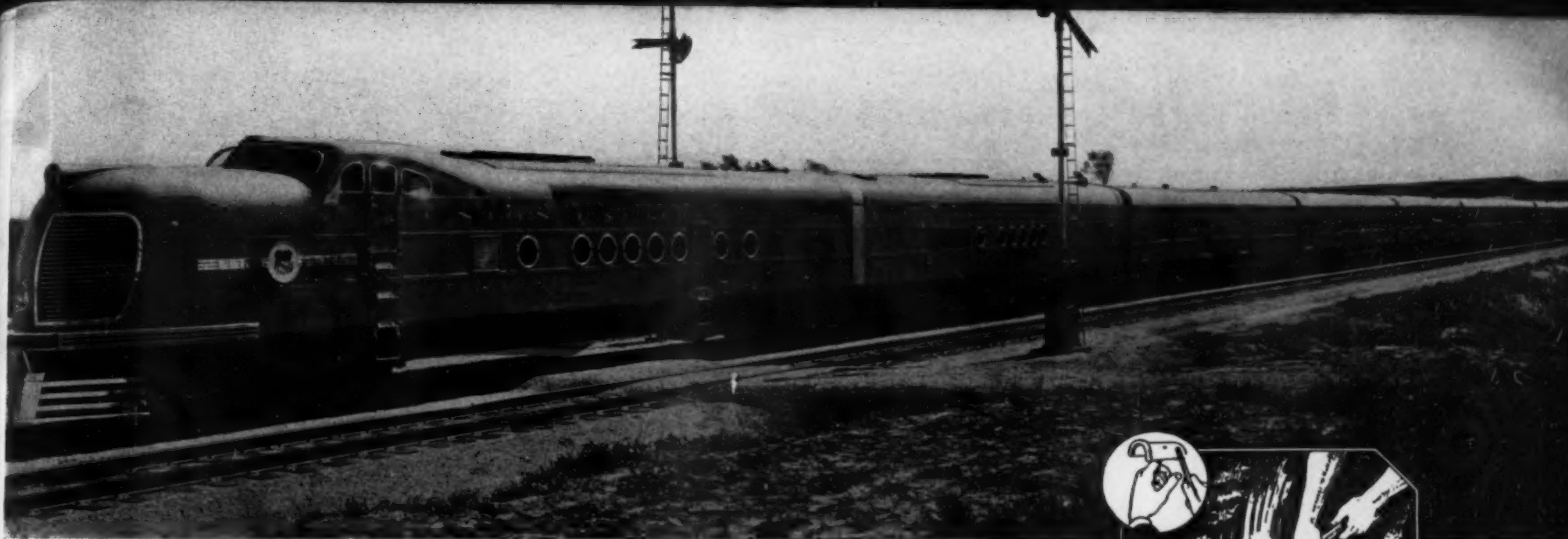

ATLAS DIESELS
Point the Trend in
Drilling



The Union Pacific's "City of Denver," which with its twin, runs between Chicago and Denver. Winton Diesels furnish the motive power. Two V-type, 16-cylinder engines, with a total rating of 2400 hp. are used in the locomotive units of both trains. Main and crankshaft bearings are Satco lined.

"TICKETS, PLEASE"

IT might almost be said that these words are the sole link between yesterday's rail transport and today's. The new streamliners placed in service by the Union Pacific and the Burlington are dated today not merely in outward appearance but also in performance. They meet the modern traveler's demand for speed, comfort, and dependability.

One of the many factors that has contributed much to the superlative performance of these streamliners is the Diesel engine. And one of the factors that has contributed to the performance of the Diesel is Satco* bearing metal. It has been the privilege of American Bearing Corporation to work with Diesel builders in designing and fabricating Satco-lined bearings for many of the Diesels used in the new streamliners.

Satco-lined bearings stand the gaff. This modern alloy has a high melting and softening point. It withstands heavy pressures and transverse stresses. It has every quality needed to meet today's power production problems. We will be glad to furnish complete information.

*A patented alloy manufactured by National Lead Company.—Trade-mark registered.

The Burlington's "Denver Zephyr," one of a pair of C. B. & Q. streamliners making the Chicago-Denver run. Winton V-type, 2-cycle engines furnish the motive power for these trains. Each is equipped with two 900 hp. units and one 1200 hp. unit. Satco-lined bearings are installed in all of the engines.

AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

INDIANAPOLIS INDIANA

CENTRIFUGAL American Bearings FORCE

FOSTER

WHEELER

Waste Heat Boilers . . .

• The Ludlow Manufacturing Company, at its Edge Moor, Delaware, Mill derives steam at the rate of 640 lb. per hour from each of three boilers operating on the heat in exhaust gases only. This steam is used in the process steam mains of the mill.

• Exhaust gases from three 1000 Hp. Winton Diesels – the largest industrial installation made in the United States in 1936 – pass through Foster Wheeler Waste Heat Muffler Boilers. The heating elements consist of gilled rings, shrunk up on boiler tubes to increase the heat absorbing surface and provide effective muffling.

• The waste heat boilers are rectangular and very compact. One is shown in the left foreground and another in the background. Cylindrical mufflers are also shown, these being used only when the boilers are shut down.

FOSTER WHEELER CORPORATION
165 Broadway, New York, N. Y.

TEXACO AT WORK

YOUR liners, rings, and bearings remain clean, free from gum and carbon . . . bearing surfaces are protected against premature wear.

You get longer continuous Diesel engine operation with Texaco Algol or Ursa Oils.

These oils are made from special crudes . . . refined by Texaco processes which give them unusual purity and stability, great film strength, and more efficient lubricating qualities.

There is a noticeable freedom from blow-by in Texaco lubricated engines. Rings remain active, compression is maintained, fuel is saved. Wear is reduced. What little carbon is formed is soft, fluffy . . . and is blown out of the exhaust.

A Texaco representative will be glad to provide practical engineering service to prove the economies of Texaco Products.

THE TEXAS COMPANY
135 East 42nd Street • New York City
Nation-wide distribution facilities assure prompt delivery

TEXACO LUBRICANTS *for all types of Diesels*

Diesel

"Alnor" Pyrometers Protect Winton Diesels on Denver Zephyr

Alnor Exhaust Pyrometer as Installed on Denver Zephyr

THE new Denver "Zephyr" recently completed by Electro-Motive Corporation for the Chicago, Burlington and Quincy Railroad, is powered with three Winton Diesel engines — a 16-cylinder 1200 hp. engine and two 12-cylinder engines of 900 hp. each, all three engines being 8 in. bore, 10 in. stroke, two-cycle type.

Because of their proved dependability for railroad service "Alnor" Pyrometers were selected to serve these engines.

Each main engine is equipped with an "Alnor" Round Type flush mounted pyrometer, with special shock resisting movement to stand the severe service encountered in locomotive use.

Wherever Diesels are used, regardless of the service, you will invariably find "Alnor" Pyrometers serving to protect the safe, efficient and economical performance of the engines.

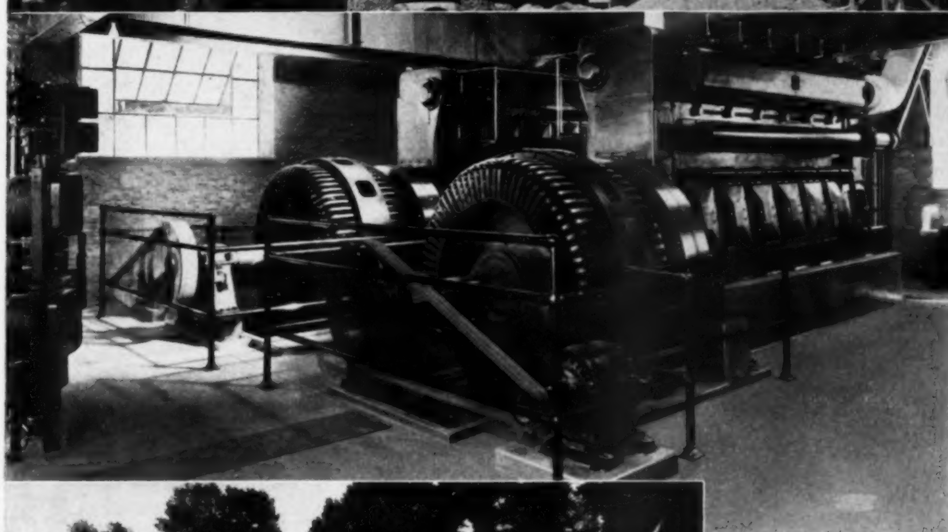
There is a size of "Alnor" for every need, a type for every requirement.

WRITE FOR COMPLETE CATALOG

ILLINOIS TESTING LABORATORIES, Inc.
423 North LaSalle Street, Chicago, Illinois

Testing Engineers and Manufacturers of "Alnor" and "Price" Pyrometers
The Products of 35 Years' Experience

Use "Alnor" Pyrometers—*The Diesel X-Ray*



Service

OVERNIGHT FROM ANYWHERE ON WESTINGHOUSE

COMPLETE ELECTRICAL ★ EQUIPMENT

Westinghouse maintains a nationwide network of service shops, each completely equipped and manned by factory-trained experts . . . to insure prompt and efficient service on all electrical equipment manufactured by Westinghouse.

No. 5 of a series showing the scope of Westinghouse Electrical Applications in Diesel Power Plants.

★ When you are planning the electrification of your Diesel-electric power plant, consider the *extra values* to be found in complete electrical equipment by Westinghouse, namely—

1. The *value* of reposing full responsibility for complete electrification in one dependable source . . .
2. The *value* of matched apparatus performance from equipment designed for operation with Diesel engine drives; and *especially* . . .
3. THE *VALUE* OF SERVICE THAT IS NEVER FARTHER AWAY THAN OVERNIGHT FROM ANYWHERE.

The latter is one consideration that is sometimes overlooked, because it is *after the fact of installation.* Don't wait until something happens *later* to discover just what sort of service to expect from the manufacturer from whom you purchase your electric power apparatus. J 10015

Demand PROMPT AND EFFICIENT SERVICE

Increased facilities for adequate service have gone hand in hand with the expanding use of Westinghouse equipment. At Westinghouse headquarters and in the field, this has become an invariable "must," and applies to apparatus designed for Diesel power plants, such as the following:

ES GENERATORS—Especially designed for lifetime operation in Diesel Service, with these extra values: *Solid Steel Rotor*, to withstand severest stresses under all conditions. *Protection against Shut-downs*, insured by exclusive high frequency pre-testing. *Positive Ventilation*, for cool running and long life.

EXCITERS—Either direct-connected or belt-driven, as required.

MOTORS—With dual-protected windings, rigid cast frames, and sealed-sleeve bearings . . . for driving compressors and other auxiliaries.

COMPLETE SWITCHBOARD ACCESSORIES—For every requirement: instruments, instrument transformers, switchgear, circuit breakers, relays.

Westinghouse

WESTINGHOUSE 1886 W 1936 GOLDEN JUBILEE

ENGINE-DRIVEN GENERATORS AND ELECTRICAL AUXILIARIES

PARKE, DAVIS & COMPANY—When the 750 HP. Type 6-DB-21, six cylinder Busch-Sulzer Bros. Diesel engine was installed at Parke, Davis & Company Erie crankshafts were again selected.

CRANKSHAFTS must be of fine quality and accurate finish to give smooth performance. Leading Diesel engine builders specify Erie crankshafts.

WE ALSO MAKE rough and finished connecting rods, piston rods, crossheads, generator and extension shafts. Complete facilities for prompt delivery on all major forged or cast steel elements required in the building and powering of every type of construction.

ERIE FORGE COMPANY

ERIE

PENNSYLVANIA

DIESEL PROGRESS

CONTENTS FOR DECEMBER

COVER ILLUSTRATION — Artist's conception of the new Winton Diesel-powered streamliner *Denver Zephyr* spanning the Rocky Mountains to establish a new non-stop speed record between Chicago and Denver.

TABLE OF CONTENTS ILLUSTRATION — Hillside Cletrac snaking logs in a Washington forest. Power is supplied by a Hercules Diesel engine.

Subscription rates: U.S.A. and Pan American Countries $3.00 per year; 25c per copy. Canada and all other countries, $5.00 per year; 50c per copy. 2 W. 45th St., New York City.

DIESEL PROGRESS

REX W. WADMAN, Editor and Publisher

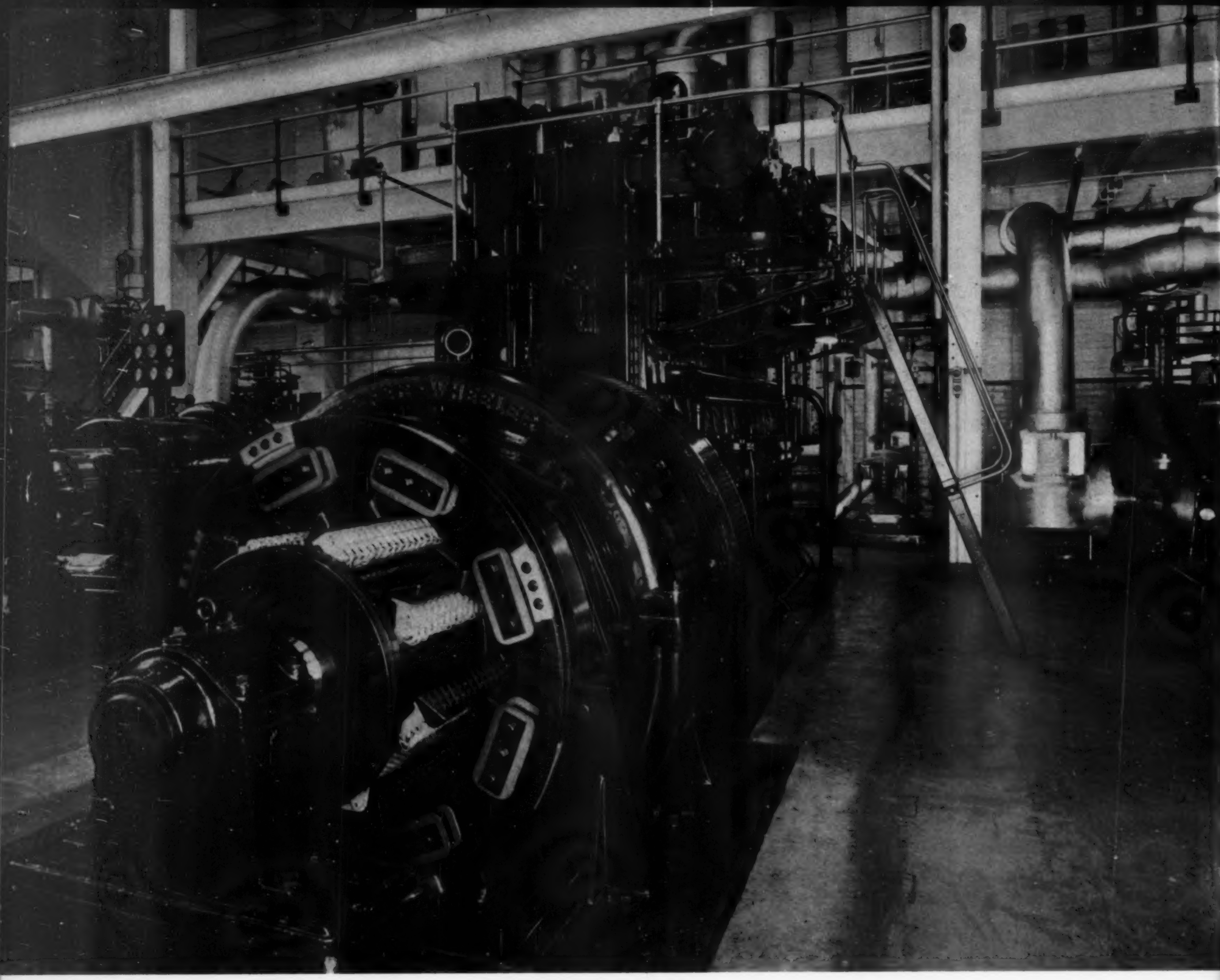
NEW YORK CITY, November 30th, 1936. Next Wednesday, December 2nd at the Waldorf-Astoria Hotel, there will be gathered together three hundred leaders in business, industry and engineering to celebrate the fortieth anniversary of the introduction of the Diesel engine into the United States.

At this luncheon the life of Doctor Rudolf Diesel will be outlined and full credit given him for the contribution he made to the world in developing what is now known as the Diesel Cycle as applied to internal combustion engines.

On pages twenty-eight and twenty-nine of this issue will be found an interesting article entitled "Dr. Rudolf Diesel—His Life." We have tried to convey to you, our readers, the background of this man and what he did, not only for his own country, but for the whole wide world. It is fitting that, on this fortieth anniversary of the introduction of his ideas into this country, we should pause long enough to look back to see what has been accomplished, so that we may better look forward to see what the future offers the Diesel Industry in this country and to give credit where credit is due to a man who started this whole marvelous development in motion.

As I write this editorial it comes to me that another year is drawing to a close, that this December issue is our last this year and I look back over the year and find the view an attractive one. Much has been accomplished within the Diesel industry this year. We've enjoyed our biggest year to date. My estimate last February of a two million horsepower year is coming true, I believe the actual figures will show even a trifle better than that nice round figure. We go into the new year full of enthusiasm, full of optimism and, in most cases, a shop full of orders. It may be well stated that Dr. Diesel "started something."

Rex W. Wadman



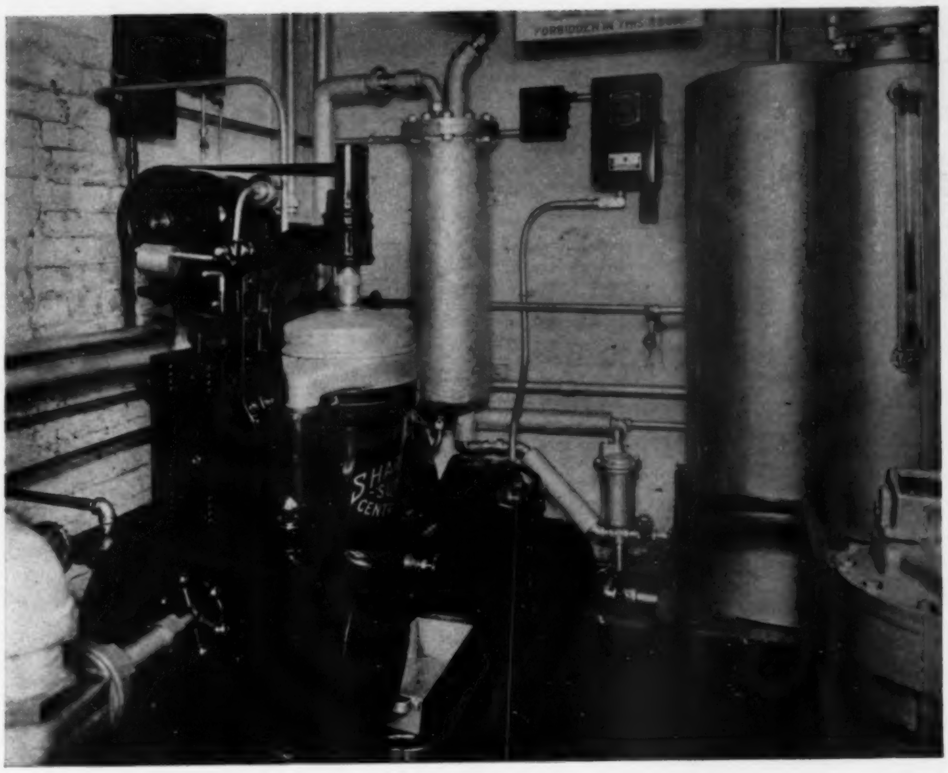
PARKE DAVIS, DETROIT

By JOHN W. ANDERSON

ANOTHER example of a story that is being repeated so often today. In their manufacturing operations, Parke Davis require electric power and process steam and, of course, steam for heating the buildings. The natural answer has been extraction type steam turbines driving electric generators. The steam supplied the necessary power in passing through the turbines and the low pressure exhaust, plus steam driven pumps and compressors, gave the process steam and met heating requirements But in recent years, the electrical load has increased more rapidly than the demand for steam. This unbalanced condition gave higher steam consumption and lowered economy.

Enter the Diesel engine into the picture. It takes the extra electrical load, and the turbines are again used to supply only the steam requirements with as much power as is available taken off as a by-product. The proper heat balance is restored with resulting economy. The plant is now flexible enough to give high economy under all of the varying operating conditions.

There are three 500 kw. turbo-generator sets and one 500 kw. Diesel engine generator set. During business hours, all of these units operate in parallel, and the Diesel unit carries approximately its full rated load. At other times, when there is no demand for heating steam, the Diesel carries all of the load, whatever that may be. Normally it is about three-quarters load. This throws the heavy burden on



Sharples en bloc centrifuge on the fuel oil line to the 500 kw. Busch Sulzer Diesel at Parke Davis. Below: Interesting cross-section elevation of the new power plant.

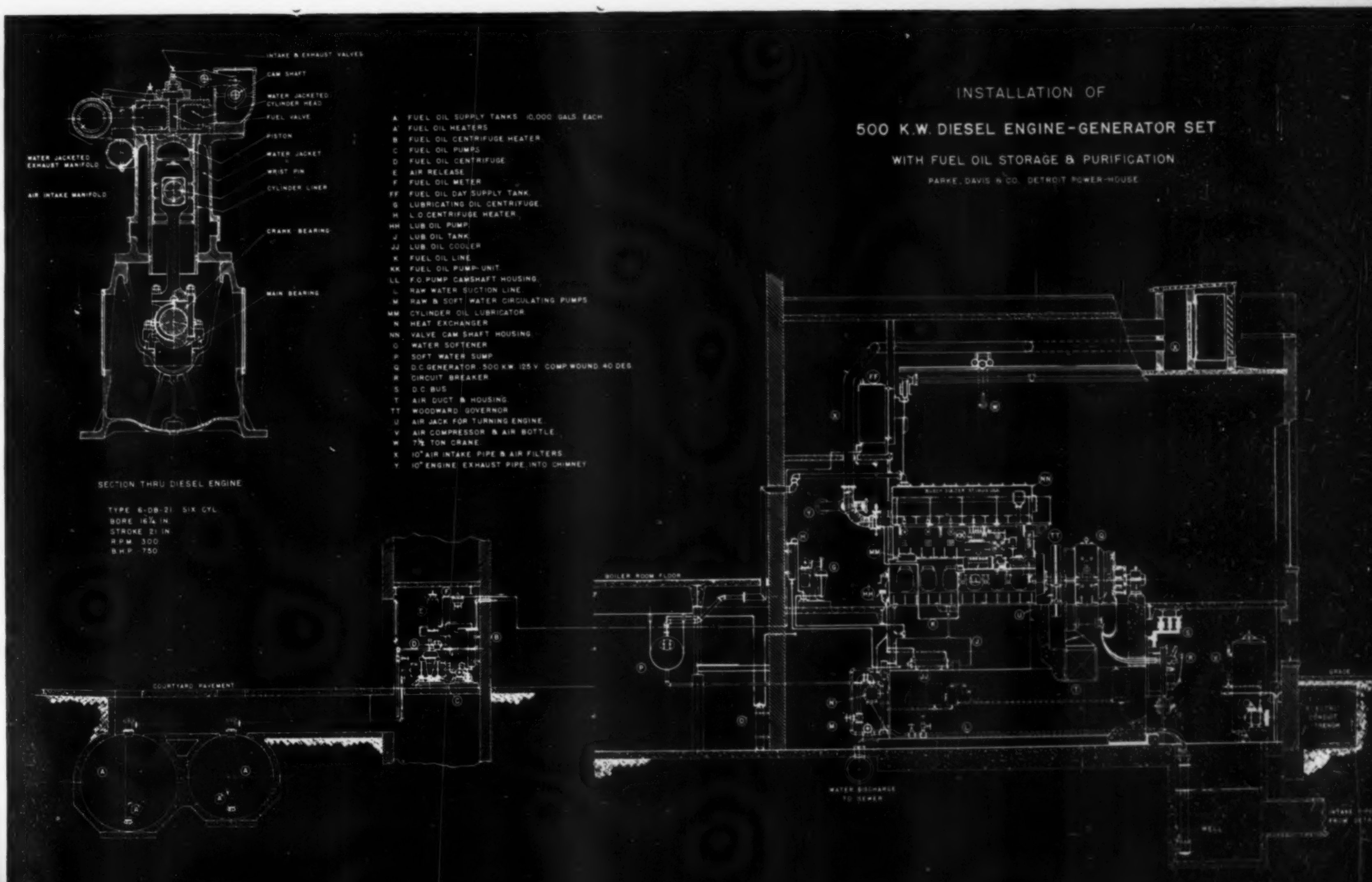
the Diesel unit, but it loads all of the units to the regions of their best economy, and this type of machinery is built to take it.

The Diesel engine and its direct connected generator are installed in an existing part of the power house on a concrete foundation block, which is supported on a layer of cork to avoid any possibility of transmission of vibration. The engine is a Busch Sulzer six cylinder, four cycle, trunk piston, solid injection Diesel with cylinders 16¼″ bore by 21″ stroke rated at 750 hp. at 300 rpm.

The generator is a 500 kw., 125 volt, compound wound, 40 degree Crocker Wheeler direct current machine. The armature is cooled by ventilation with filtered outdoor air. The generator is protected by a 5,000 ampere ITE circuit breaker. This breaker and the field rheostat are handled by remote controls from the switchboard.

Engine air intake is through a 10″ insulated steel pipe, which leads from the end of the engine header upward to a small brick house for the American air filters on the power house roof. An insulated 10″ exhaust pipe leads from the engine exhaust header to an old unused brick stack, which serves as a very good muffler. Both intake and exhaust pipes have sections of Eclipse flexible pipe adjacent to the

. . . . *And now pease turn to page 54*



DIESEL SNOW CONTROL

By DONALD M. TAYLOR

The countryside was frozen fast,
But o'er a cut-and-fill there passed
A youth, who skinned 'mid snow and ice
A "cat" which bore this strange device:
DIESEL
— With apologies to Longfellow.

IN territory where winter is winter, construction contracting is customarily considered a seasonal occupation. When cold winds bring snow, ice and zero temperature, jobs fold up and bookkeepers unlimber their red ink pens.

But there are contractors who rebel against this dictum that scatters crews which have been organized with great labor and expense, that ties up costly equipment and adds the contractor himself to the roll of unemployed. They insist on keeping jobs open just so long as wheels can be turned economically. Diesel powered equipment is supporting them in this rebellion.

Last winter was a tough one throughout most of this country, one of the coldest on record. But many a construction contractor moved dirt all winter long with Diesel powered equipment.

In Idaho, for example, according to reports, every construction job was shut down tight through the worst of the cold spell — with one exception. Quinn-Robbins Co. had a contract to excavate 80,000 yards on a state job between Horse Shoe Bend and Emmett, along the Payette River. This included about 10,000 yards of solid rock. Caterpillar Diesel tractors were put on the job with a Le Tourneau Angledozer and a Le Tourneau 8-yard Carryall. These tools bit so well into the dirt and rock right through the frost that Quinn-Robbins kept on plugging all winter. With the Angledozer they chewed mud and huge boulders out of the hillside and shoved them over the bank into the Payette River. At $1.00 a yard, every "plunk" meant a plunk or two in the Quinn-Robbins coffers.

Somebody won a prize a few years ago with a poem titled, "Hot Days There Have Been in Montana." C. A. Emerson, foreman for Blanchard Bros. of Denver, might write one called, "Was It Cold in Colorado!" It sure was last February on an 18½-mile relocation job

on State Route No. 81, between Roggen and Wiggins, about 80 miles northeast of Denver. Once the mercury dropped to 25 degrees below, and there was sub-zero weather for many days, but the job went right on without any loss of time. The material they were handling was sandy soil to blow sand, and it was frozen two feet deep, so solid as to look and work like sandstone. A Le Tourneau Rooter was used to tear it up for the scrapers.

Four 95 hp. Diesel tractors were employed to power the five 12-yard Carryalls and the Rooter. Four of the Carryalls were operated in tandem — two to a tractor — and they made excellent yardage records through all the ice and cold. On a 2,200-ft. round trip the tandems, hauling from the two ends to the middle, which gave two loads per Carryall per round trip, made six cycles hourly which, at eight pay yards per unit, was 192 yards an hour. The sure-firing 95 hp. Diesels experienced no difficulty pulling the tandems, which were loaded one Carryall at a time.

Michigan, likewise, saw low mercury last January, but the icy gales blowing off Lake Superior

could not freeze Loomis Construction Co. off a dirt-moving job at Marquette. With a Diesel tractor and an 8-yard Carryall they worked 20 to 24 hours a day right along. In one 600-hour month they averaged 42 pay yards per hour, a total of 25,000 yards as measured by the project engineers, over a 2,000-ft. one-way haul. The top soil was sandy loam for a depth of two or three feet and was frozen 12 to 20 inches deep. It takes power to break up such frost-bitten ground, power that beats powerfully and positively despite weather.

John F. Bloomer, Wisconsin contractor, saw the old year out and the new year in on a brand new job last winter. December 31 he started a 416,000-yard contract covering 5 miles of grading on Highway No. 2, just east of Iron River, Wisconsin. Three 95 hp. Diesel tractors were on the job, pulling three 12-yard Carryalls.

About January 3 the mercury slipped below the zero line and from then on to mid-February every day saw weather from 6 to 40 degrees below. But Bloomer's crew lost very little time because of weather conditions. In 2,000 tractor hours he moved an estimated 140,000 cubic yards an average of 600 feet, and this despite some two and a half feet of snow and the sand in which he was working being frozen two to eleven inches deep.

These are but four of undoubtedly many instances where through the bitter cold of the severest winter in many a year Diesel powered equipment not only worked satisfactorily, keeping construction projects moving, but made excellent dirt-moving records, made records where most equipment would have quit and hibernated for the winter, and not only did these Diesels themselves keep running, but with earth-moving equipment they pushed and hauled snow away to keep highways, trails and streets open for other business.

In the vicinity of Peoria, Illinois, snow drifts were frozen three to six feet high over the roads, so that ordinary snow plows just couldn't do anything about it. The Illinois State Highway Department gave North American Engineering Co. the job of digging the country out.

A Caterpillar 95 hp. Diesel tractor with a Le Tourneau Angledozer dug through the snow drifts, pushing the snow off the roads and lifting it up over the roadside drifts. The front sheave on the Angledozer was lowered to the middle of the back of the bowl to increase the lift from 42 inches to about 54 inches. Exerting pushing energy through the tractor treads and lifting power through the Angledozer, motivated by the Le Tourneau Power Control Unit, the Diesel engine quickly cleared lanes for traffic.

Similarly Percy Rutledge, Cascade, Idaho, contractor, dug his home town out from under five feet of snow, using an Angledozer mounted on a 45 hp. Diesel tractor.

Over in Fargo, North Dakota, it snowed and kept on snowing for several weeks. The city fathers kept pushing the snow back from the center of the streets with plows and maintenance equipment until there just was no pushing room left. Banks of snow two to four feet deep flanked each sidewalk and underneath was a layer of ice two to six inches thick. Something had to be done. Dakota Tractor and Equipment Co. did it by coming out one blustery day with a huge 12-yard Le Tourneau Carryall coupled to a Caterpillar 95 hp. Diesel tractor. Down dropped the scraper blade into a big bank and soon the scraper was heaped high with snow. In six hours they cleared six 350-ft. blocks, disposing of the snow in the City Park and in a vacant lot. The result of this demonstration was completely to sell the Fargo administration on Diesel Equipment.

Sumpter Valley Dredging Co., Sumpter, Oregon, uses a 45 hp. Diesel with an Angledozer to keep roads open and to sledge fuel to its dredger so an uninterrupted schedule can be maintained throughout the winter, and just a few miles away the Campbell Oregon Mining

. . . . *And now please turn to page 54*

DENVER ZEPHYRS

Burlington Diesel Train Sets New Non-Stop Speed Mark on Chicago to Denver Run, Covering 1,017 Miles in 12 Hours 12 Minutes

TWO new streamlined super Zephyrs, christened the "Denver Zephyrs," have been added to the fleet of four Burlington Diesel-powered streamlined trains now in service.

These twelve-car, stainless steel, completely air-conditioned speed trains, the largest of their type ever constructed, now operate daily on an overnight schedule between Chicago and Denver, replacing the two three-car Zephyrs which have established an amazing record of performance since May 31, when they were placed in 16-hour, overnight service between the two terminals.

The new Denver Zephyrs not only feature all of the latest travel comforts introduced by the streamlined era, but offer many innovations of their own which emphasize even further the comfort and luxury of present day rail travel. A few of these improvements are:

110 volt electric outlets in all wash-rooms, drawing rooms, bedrooms and compartments for electric razors, pads, curling irons, etc.

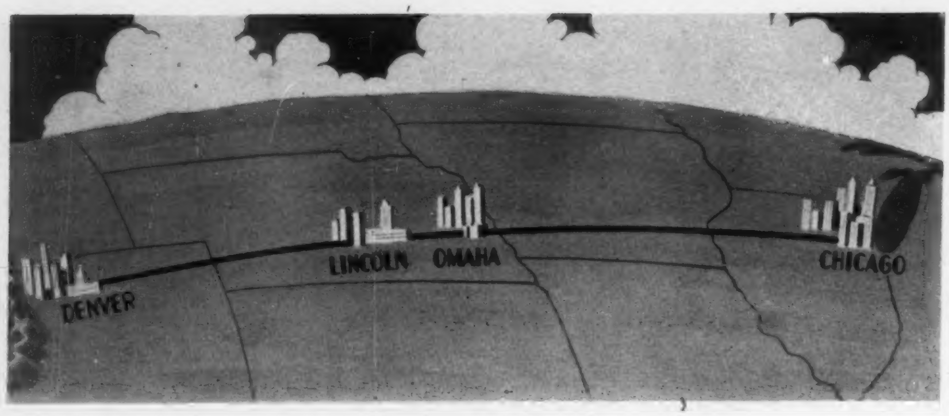
Telephone service between cocktail lounge, diner and parlor-observation lounge car.

Individual radios for each drawing room, bedroom and compartment.

Individual air-conditioning control in drawing rooms, bedrooms and compartments.

Unique air curtain in diner to eliminate all kitchen odors.

The overall length of these new Zephyrs from stem to stern is 883 feet 9 inches. Each of the passenger-carrying cars is two and one-quarter inches wider inside than conventional equipment. The two power cars built by Electro-Motive Corporation, in which are housed the Winton V type two cycle Diesel engines, totaling 3,000 hp., comprise the first two units of these new "Silver Streaks." Directly following



"Denver Zephyrs'" Daily Schedule

Westbound — Read Down			*Eastbound — Read Up*	
5:30 PM	Lv.	Chicago (CST)	Ar.	8:50 AM
c6:02 PM	Lv.	Aurora	Ar.	M
7:42 PM	Lv.	Galesburg	Ar.	6:38 AM
8:24 PM	Lv.	Burlington	Lv.	5:58 AM
9:32 PM	Lv.	Ottumwa	Lv.	4:45 AM
11:18 PM	Lv.	Creston	Lv.	2:54 AM
1:04 AM	Ar.	Council Bluffs		
1:15 AM	Ar.	Omaha	Lv.	12:59 AM
2:15 AM	Ar.	Lincoln	Lv.	11:58 PM
3:48 AM	Ar.	Hastings	Lv.	10:25 PM
5:38 AM	Ar.	McCook (CST)	Lv.	8:30 PM
q	Ar.	Ft. Morgan (MT)	Lv.	y
8:30 AM	Ar.	Denver (MT)	Lv.	4:00 PM

c — stops to receive revenue passengers for Omaha or beyond.

q — stops to discharge passengers from Chicago.

y — stops to receive revenue passengers for Chicago.

M — stops to discharge revenue passengers from Denver.

the two power cars is a car devoted to handling U. S. mail between Chicago, Council Bluffs, Omaha, Lincoln and Denver. Special double strength arm type mail catchers pick up the mail at a number of intermediate stations while the train is traveling at high speed, thus providing extraordinarily fast railroad mail service at regular postal rates. In this same car are located four Cummins auxiliary Diesel engines, which generate ample power for the operation of all air-conditioning units and electric lights throughout the train. In the rear part of the fourth car is located a splendidly appointed cocktail lounge.

The fifth car is the forward coach, having a seating capacity of 64 passengers. Here individual seats which both recline and rotate contribute to the comfort of coach passengers. The sixth car is also a coach car, with a seating capacity for 38 passengers.

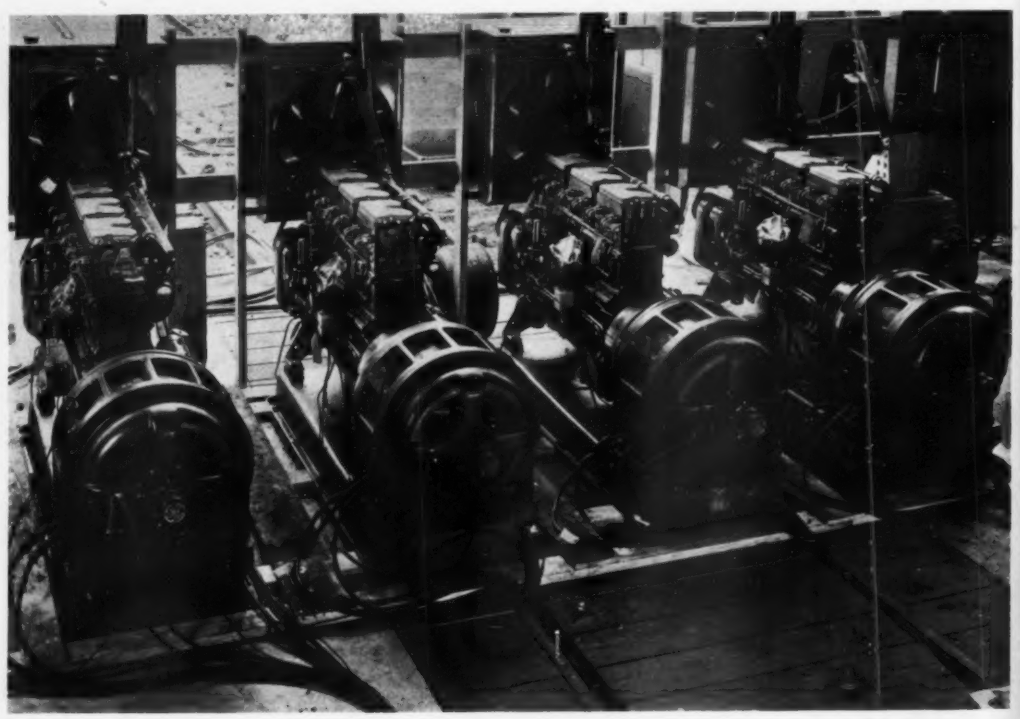
The seventh car on each of the new Denver Zephyrs has been devoted to dining facilities. This car will seat 40 passengers and is colorfully decorated with smart harmony between the walls, chairs and carpeting. Radio and phonograph reception is available in the dining room. An unusual feature of this car is the unique air-curtain designed to prevent odors from the kitchen entering that part of the car devoted to dining purposes.

A most unusual feature has been introduced in the new Zephyrs in the establishment of telephone service between the dining car, the cocktail lounge and the buffet car at the rear. This service makes it possible for passengers to phone the dining car from either the cocktail lounge or the observation car to make table reservations or to order refreshments served in any part of the train.

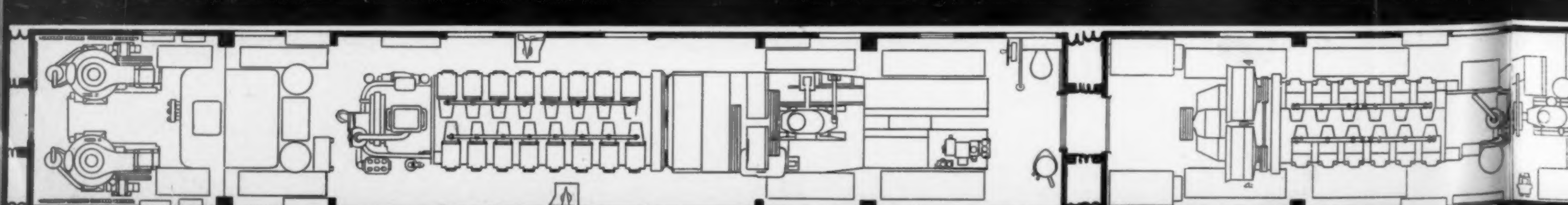
The eighth, ninth and tenth cars of the Denver Zephyrs are all 12-section Pullman sleeping cars. The seat cushions in the sleepers, as well as the mattresses used when the berths are made down, are of special porous rubber.

The eleventh car is an all-room sleeper with drawing room, bedrooms and compartments which can be used either individually or made up en suite. Each room in this car is complete in itself with private toilet facilities.

The twelfth car on each train is a parlor and observation lounge, providing ample lounge facilities for the Pullman passengers. Located at the forward end of this car are ten commodious revolving and reclining parlor chairs. Two sections for card tables, together with a writing desk and a generous number of com-



The Cummins auxiliary Diesel generating sets on test before being installed on the Burlington Zephyrs.



fortable lounge chairs are also part of this car's equipment.

A highly trained personnel has been selected to look after the comfort and convenience of all passengers on the new Denver Zephyrs. Aside from the usual train crew, there are picked attendants in charge of the cocktail lounge and the buffet in the rear of the lounge car, a porter to assist in the coaches, and complete valet service. A hostess, usually referred to as a "Zephyrette," is also in attendance on each train to further look after the comfort of the travelers.

Due to the fact that the Denver Zephyrs are named after, and have, as one of their terminals, the mile-high metropolis of the Silver State, each of the cars has been given a name with the prefix "Silver." Silver mining has played an important part in the history of Denver and the State of Colorado, and the silvery brightness of the stainless steel used throughout in the construction of the new Denver Zephyrs adds further to the appropriateness of the names selected.

Like their predecessors, the Denver Zephyrs are constructed with low center of gravity. Contributing to the service flexibility of the new Zephyrs is the fact that they are not completely articulated, but instead, between some of the cars a "tight-lock" coupler is used, giving to a great degree the same benefits of an articulated truck, but making it possible to cut in and take out cars when occasion requires.

The very latest improvements in the science of air-conditioning have been used throughout the trains. No windows in any of the passenger cars need be opened, as a generous supply of outside air is constantly being drawn in by means of an electrical suction fan, filtered and cleansed of dirt, dust and other impurities. The heating and cooling facilities of the train are thermostatically controlled, assuring even and comfortable temperatures at all times.

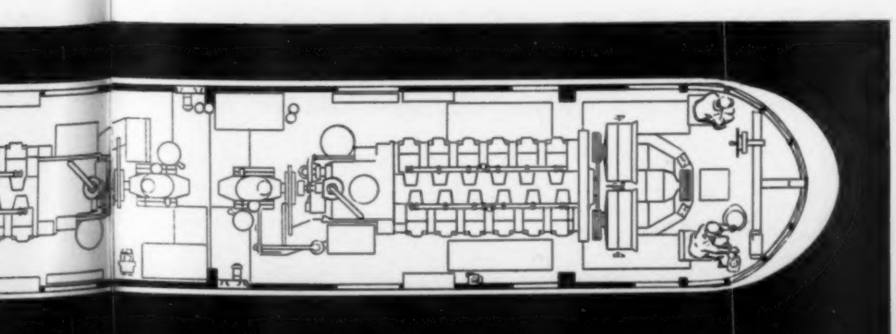
The wide Zephyr-type windows in all the passenger-carrying cars are of double plate safety glass. They are hermetically sealed, and the space between each of the double windows is filled with dry nitrogen, which prevent frosting of the windows regardless of the outside weather and assures passengers an unobstructed view of the landscape at all times.

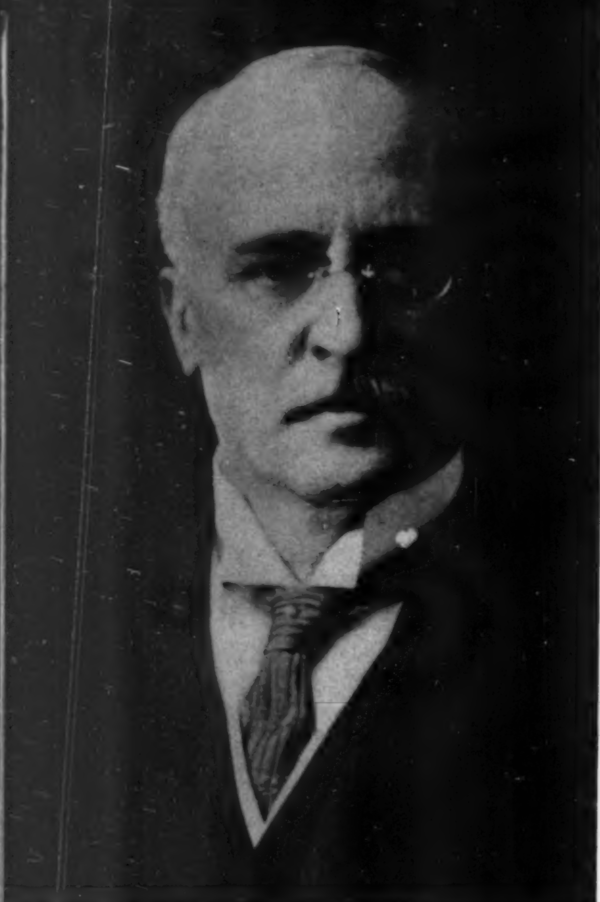
The revenue cars of the new Denver Zephyrs were built by the Edward G. Budd Manufacturing Company of Philadelphia, and are equipped throughout with roller bearings. All of the cars are constructed of stainless steel, a comparatively new lightweight metal of great strength, containing 18 per cent chromium and 8 per cent nickel, the bright unpainted surface being immune to atmospheric corrosion. Fabricated by the "Shotweld" method, rather than with rivets, each car is virtually one piece of indestructible stainless steel.

One of the Winton V type, two cycle main Diesel power units as viewed from the side aisle of the Zephyr power car.

Following the inauguration of the Denver Zephyrs, the Burlington Railroad will put into service two new Twin Zephyrs of much larger capacity than the smaller stainless steel, streamlined trains that have been following the route of the Mississippi River to and from the Twin Cities since April, 1935. This will give the Burlington a fleet of eight Diesel Zephyrs in all and certainly provides substantial proof that this progressive railroad has successfully adapted this modern form of power.

Plan view of the "Silver King" and "Silver Queen," the first two units comprising the new Denver Zephyrs, which are devoted to motive power. The remaining ten units contain baggage and passenger accommodations.





Dr. Rudolf Diesel, inventor of the Diesel engine.

DR. RUDOLF DIESEL

HIS LIFE

By PAUL H. WILKINSON

All photographs through the courtesy of German Railroads Information Office, New York.

Rudolf Diesel at an early age.

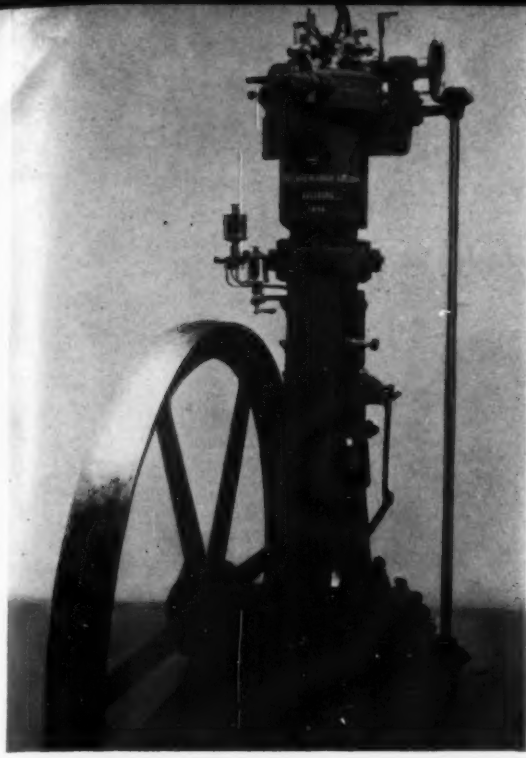
FEW names are as closely identified with the progress of modern times as that of Rudolf Diesel, world renowned inventor of the oil-burning engine which bears his name. The name Diesel has become so commonplace that few people who hear or see it, realize to whom the credit for this marvelous invention belongs. It would perhaps be well, therefore, to go back fifty years or so and trace the conception and development of the engine which has solved so many of our problems today.

Rudolf Diesel's early years were quite eventful. He was born in Paris of German parents on March 18, 1858, his father being a manufacturer of leather goods. At the age of twelve, he was obliged to leave the city of his birth, as the siege of Paris in 1870 made it impossible for Germans to remain. With scant means, the family fled to London, where his father, with much difficulty, built up a small business. In order to lighten the financial burden of the family, as well as to give young Rudolf a German education, he was sent to relatives in Augsburg. Here, in the old home of his family, he completed the schooling he had started in England. Later, he entered the Polytechnic School at Munich to study engineering. He had a mechanical turn of mind, even as a child, and had been in the habit of spending his days in the technical museums of Paris, looking at the models and drawings. The quiet young student soon began to show his unmistakable mechanical talent, and happily for him, someone was found who was willing to help him start on his career.

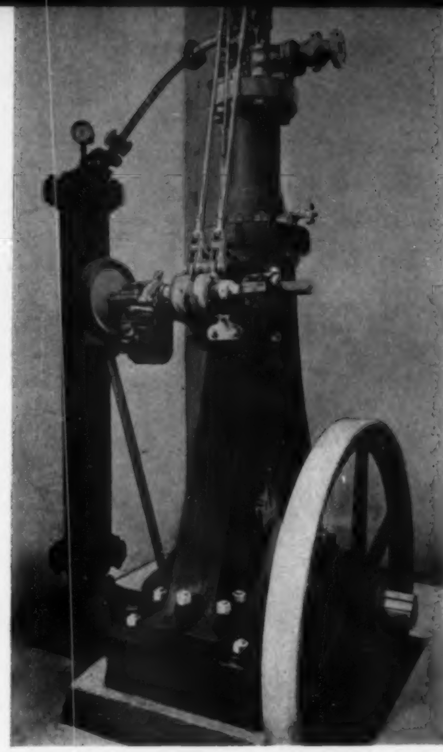
When Diesel was studying in Munich, his teacher, Linde, the dicoverer of liquid air, happened to mention one day that in a steam engine only from six to ten per cent of the heat produced could be transformed into energy. The rising young engineer made a note in the margin of his text-book as follows: "Investigate whether it is not possible to make practical use of the isotherms." From this time on, the idea of a new power-saving engine remained fixed in his mind.

Soon afterward, he became assistant professor at the college at Munich, and later he was employed as the manager of a refrigeration plant in Paris. It was in the latter city that he began to make definite plans for the development of his engine. In 1893, at the age of thirty-five, he published a theoretical treatise entitled, "The theory and construction of a rational heat engine." In the same year he commenced his practical experiments. Two of the leading German industrial concerns — Krupp of Essen and the Augsburg Machine Works — furnished him with the necessary capital and other facilities for the construction of his engine. It was in Augsburg, the home of his family, that he commenced his work. The diary kept in his laboratory testifies to the enormous amount of time and labor which had to be spent on his invention. Several years passed and many machines and engines were built before one was finally found which ran according to the theory which he had worked out. In spite of many failures, the generosity and foresight of his financial backers saw the work through to a successful conclusion, while he himself, with true German thoroughness, carried out his idea.

In 1897, several engines were constructed which successfully passed their tests. They were of the large, slow-speed type for stationary use, of very heavy construction. At the Machine Exposition at Munich in 1898, the Diesel engines constituted the biggest attraction. In



The first experimental Diesel engine, 1896.



The first practical Diesel engine for industrial use, 1897.

spite of occasional setbacks, within a few years his invention proved itself to be an unqualified success. Patents were taken out in several countries, and licenses to manufacture were granted. Well-known concerns such as Sulzer in Switzerland and Nobel in Russia began to build the engines on a large scale. The Diesel engine became especially important, if not vital, to modern shipbuilding, where every cubic foot of space counted. Bearing in mind the size of the coal bunkers and the large crews of stokers required to tend the boilers, it stood to reason that the new engine would be invaluable on the sea. In fact, the marine engines were developed so successfully within a few years that by 1912 there were twenty-eight factories in different parts of Europe engaged in building Diesel engines for ships.

During the fifteen years which followed the successful outcome of his invention, Diesel was flooded with invitations to foreign countries where he was honored and feted, and was asked to address conventions. His journey to the United States in 1912 was like a triumphal tour. Himself a man of modest and refined tastes, he devoted a portion of his wealth to social welfare, for even as a student he had been keenly alive to a man's social responsibilities. But over his brilliant career shadows were beginning to fall. Untiring work and endless journeys in the interests of his enterprises began to undermine his health. His desire to have his own fuel supply led him to invest in oil fields, and these undertakings ended in failure. In spite of all his former successes, financial difficulties beset him, and just as a struggling young man he had been loath to accept help from others, so now he disdained outside assistance. He was a self-made man in the true sense of the word — a bold inventor and a courageous pioneer.

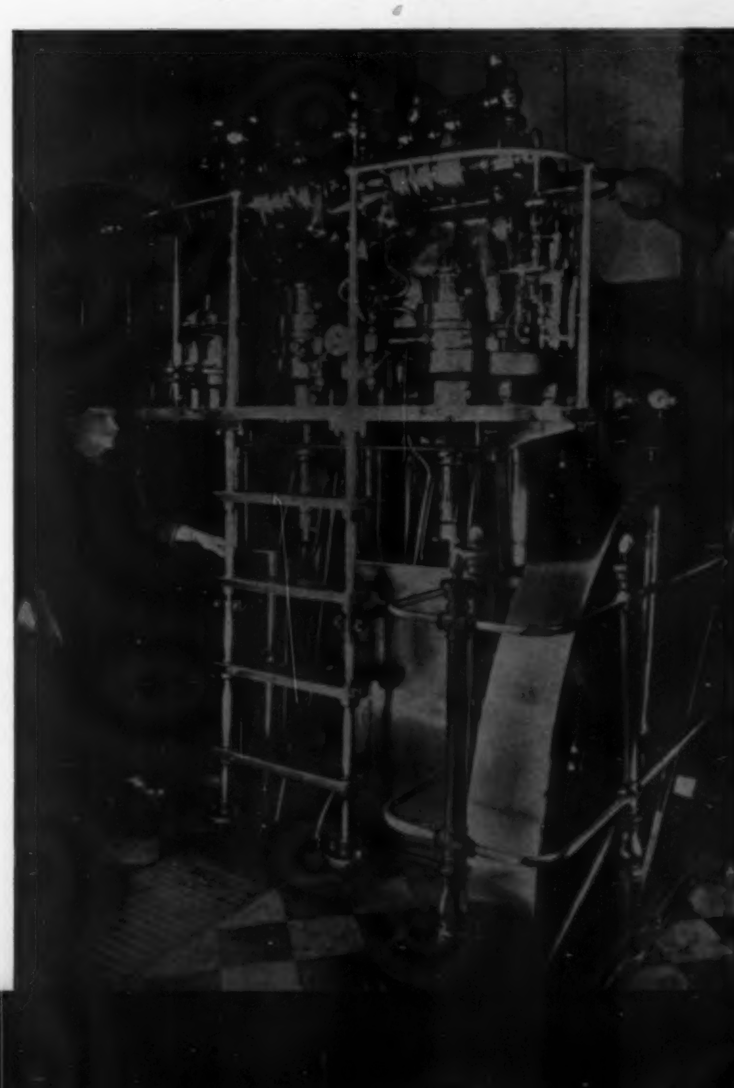
Vicissitudes and broken health undoubtably accounted for his tragic death, around which there has always been a certain amount of mystery. On his way to England for a consultation with the British Admiralty, he disappeared on the night of September 29, 1913, while crossing from Antwerp to Harwich. Thus passed Rudolf Diesel, whose inventive genius still lives on land, on the sea and in the air — his great work perpetuated by the engines which bear his name.

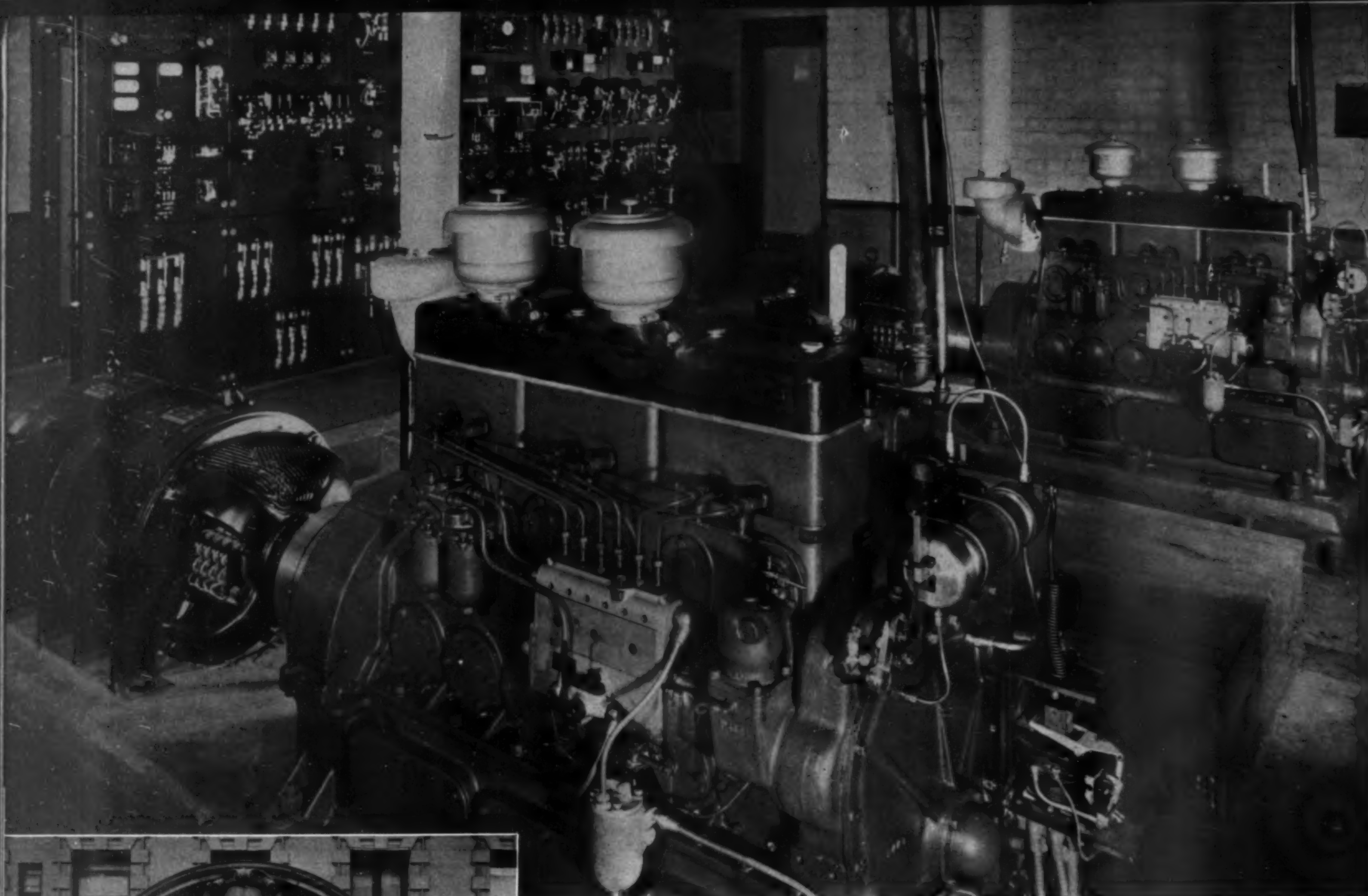
If he could be with us now, Dr. Diesel would indeed marvel at the many uses which are being made of his engine. At the time of his death, the submarine had been made possible by his invention — now pocket battleships are propelled by powerful Diesel engines. Most of all, he would have marvelled at the use of his engine in the air, which has only been accomplished after many years of patient toil.

Dr. Diesel's work was very appropriately taken up by a fellow countryman — Dr. Hugo Junkers — to whom credit is due for the remarkable Diesel airplane engines which are proving so successful throughout the world. Dr. Junkers too, has now passed on, but he has left behind him a worthy monument to his perseverance — the only practical Diesel airplane engine in the air today. He pointed the way to real safety in the air — let us see if we too can be as progressive by adopting a really safe engine!

In previous issues this department has followed foreign Diesel aviation progress. What will America do?

One of the oldest two-cylinder Diesel engines in industrial use today.





Auxiliary equipment on the Superior Diesels includes Air-Maze air intake filters while fuel and lubricating oil filters are Purolator and Cuno respectively. The Burgess exhaust mufflers are suspended from the ceiling by coiled springs and do not appear in this view.

57 WEST 75th STREET NEW YORK CITY

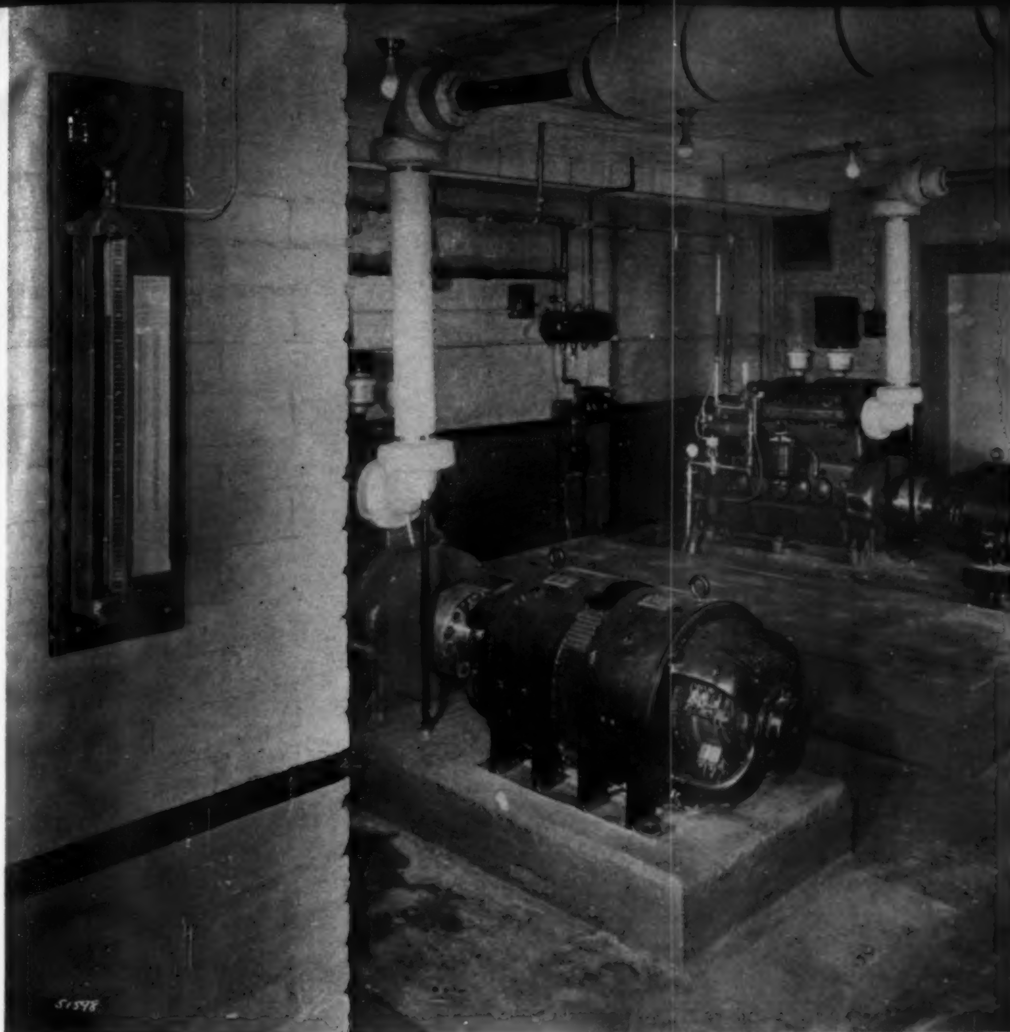
By C. F. STRONG

THE owners of the La Rochelle Apartments, at 57 West 75th Street, New York City, are vitally interested in any savings possible in operating expense. Several years ago they entered into a contract with the Petroleum Heat and Power Company for the installation of automatic oil burning equipment to improve their heating system. The results of this innovation were not only more satisfactory operation but, what is much more important, appreciable saving in heating costs. Continuing their progressive attitude toward efficient building management, a second contract was recently negotiated with the same company which called for the installation of an automatic Diesel-electric generating plant.

A careful survey of the building and its power requirements indicated that the entire demand could be supplied by two Diesel-generator units with an aggregate capacity (both AC and DC) of 40 kw. each. Superior Diesels and Burke generators were selected, each Diesel driving a 240-volt, 15 kw., DC generator and a 25 kw., 3-phase, 4-wire 120-208-volt synchronous AC generator. The two units are mounted in tandem on a common shaft with the rotating parts properly supported on ball bearings. The building owners decided for the present to install two such generating units and to retain public service as standby although, in designing and erecting the plant, a third foundation was indicated and built. Thus, it will be a simple matter at any future date to add a third Diesel-generator set and dispense with the more expensive outside standby service.

The power demand for operating the elevators and other motorized equipment is 240 volts DC while the tenant demand and other building lighting is operated on 120-208-volt, 3-phase, 4-wire system. Automatic control was selected to make possible lower labor charges, better service and better voltage regulation. Among the many interesting technical features of this plant perhaps the most important is the automatic paralleling of the AC generating units.

Except for minor changes peculiar to this job,



The Petrometer distant-reading fuel tank gauge is prominent in the foreground.. Viking fuel transfer pumps (also on the wall) appear behind each engine. Below: The Philco battery room.

the scheme of automatic control of Diesels and generators is similar to that of numerous other plants operating under the Automatic Diesel Electric patents. Representative of these are the Broadway Central Hotel, The Midston House and Ye Eat Shoppe. The last was fully described in the August, 1936, issue of DIESEL PROGRESS. The AC generators are synchronized simply by allowing the incoming unit to reach its speed, closing the 3-phase circuit directly on the line with the operating machine and, an instant later giving the unit its field. The machines pull in under this system with practically no disturbance providing that they are specifically designed for this type of service. A Simplex voltage regulator on the switchboard controls the motor-generator exciter set which furnishes the field current for either or both of the alternating current generators. The Superior Diesels provide a generator shaft speed of 1,200 rpm. Fluctuations of line load are equalized through the medium of a Philco storage battery system. This gives the same execellent voltage regulation and performance as has been secured in the past on similar automatic installations.

There are doubtless a great many building owners and operators who have been seriously considering the marked economy and numerous other advantages of a Diesel generating plant yet who have hesitated to install internal combustion engines in the basement beneath rented apartments. Noise and vibration cannot be tolerated nor is there any good reason why they should be considering the present day methods of Diesel installation and operation. At this apartment no one on 75th Street, in the main lobby or anywhere else in the building would know that the plant is operating. Exhaust noise is eliminated by Burgess silencers. Vibration is completely isolated by Korfund natural cork underneath and around the machinery foundation. It is interesting to note that Korfund have engineered the vibration problem on every Automatic Diesel Electric installation to date and have produced most satisfactory results in each case.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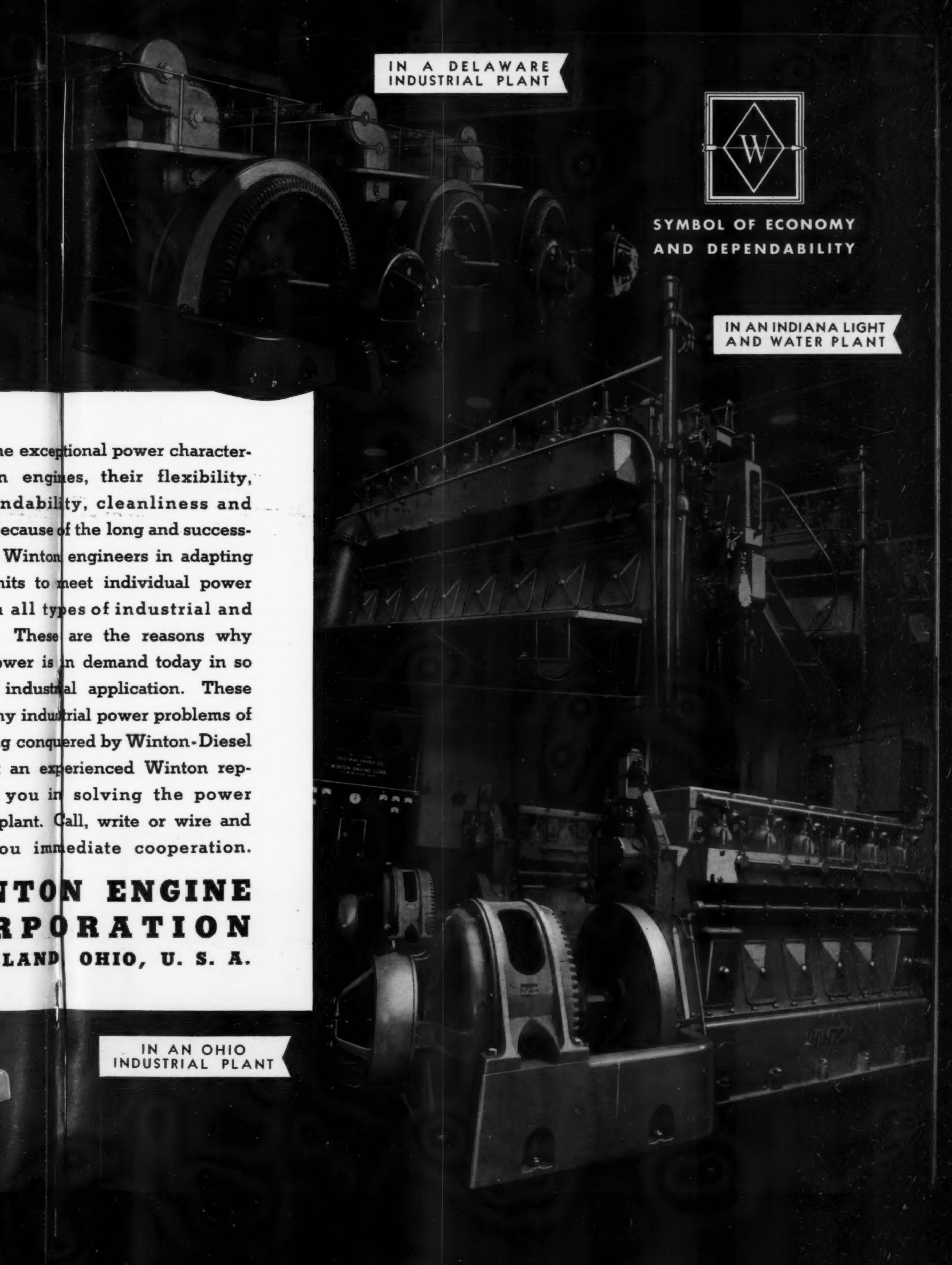
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NTON ENGINE
RPORATION
LAND OHIO, U. S. A.
IN AN OHIO INDUSTRIAL PLANT

Part of the force responsible for the successful operation of Cameron's Diesels: Harry Brant, Assistant Engineer; John Siever, Chief Engineer, and James Corn, City Electrician.

CAMERON, MISSOURI

Twelve Years of Diesel

By BENNETT B. SMITH

THE old steam driven plant in Cameron, Missouri, was laboring along rather independently and temperamentally, not fully decided just when she would give up the ghost and quit for good. She had worked thirty-five years with ever increasing trouble and worry to the town as the years rolled by. Coal was high priced and hard to get; satisfactory help was not always available; a large well was used for water and this often ran short; smoke from the stack rolled over the business section.

These difficulties were making service poor and cost of production high. There were frequent shutdowns. With the changing times 24-hour service had been inaugurated and many motors depended upon the plant. A new plant was, it seemed, imperative. It came.

The present modern layout, which has now been in operation the past twelve years, is the answer to these demands. Twelve years of Diesel generated power have proved that no mistake was made in its construction.

The new plant was built in 1924 and began operation October 5 that year. Three Fairbanks-Morse units were installed, two of 300 hp., 200 kwh. and one 200 hp., 135 kwh. This was thought to be of ample capacity for many years to come.

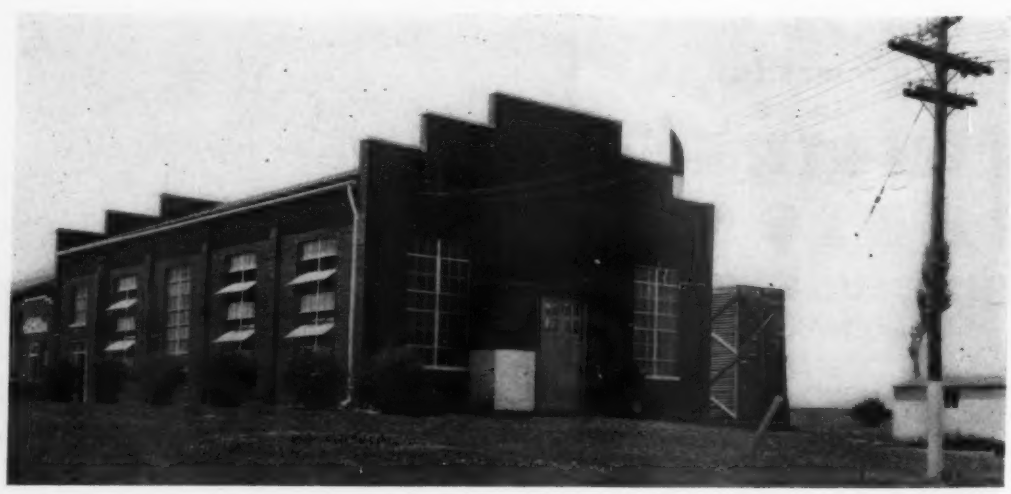
The first year 1,078,380 kwh. were produced, the amount increasing each month from 81,920 kwh. the first month to 100,600 kwh. in September, the end of the fiscal year. To produce this current it required 122,877 gallons of fuel oil at a cost of $6,023.60 and 1,867 gallons of lubricating oil at a cost of $1,186,.45 or a total of $7,210.05. Repairs for the first year were $5.00 and salaries averaged $350 per month. The total was something like $11,500.

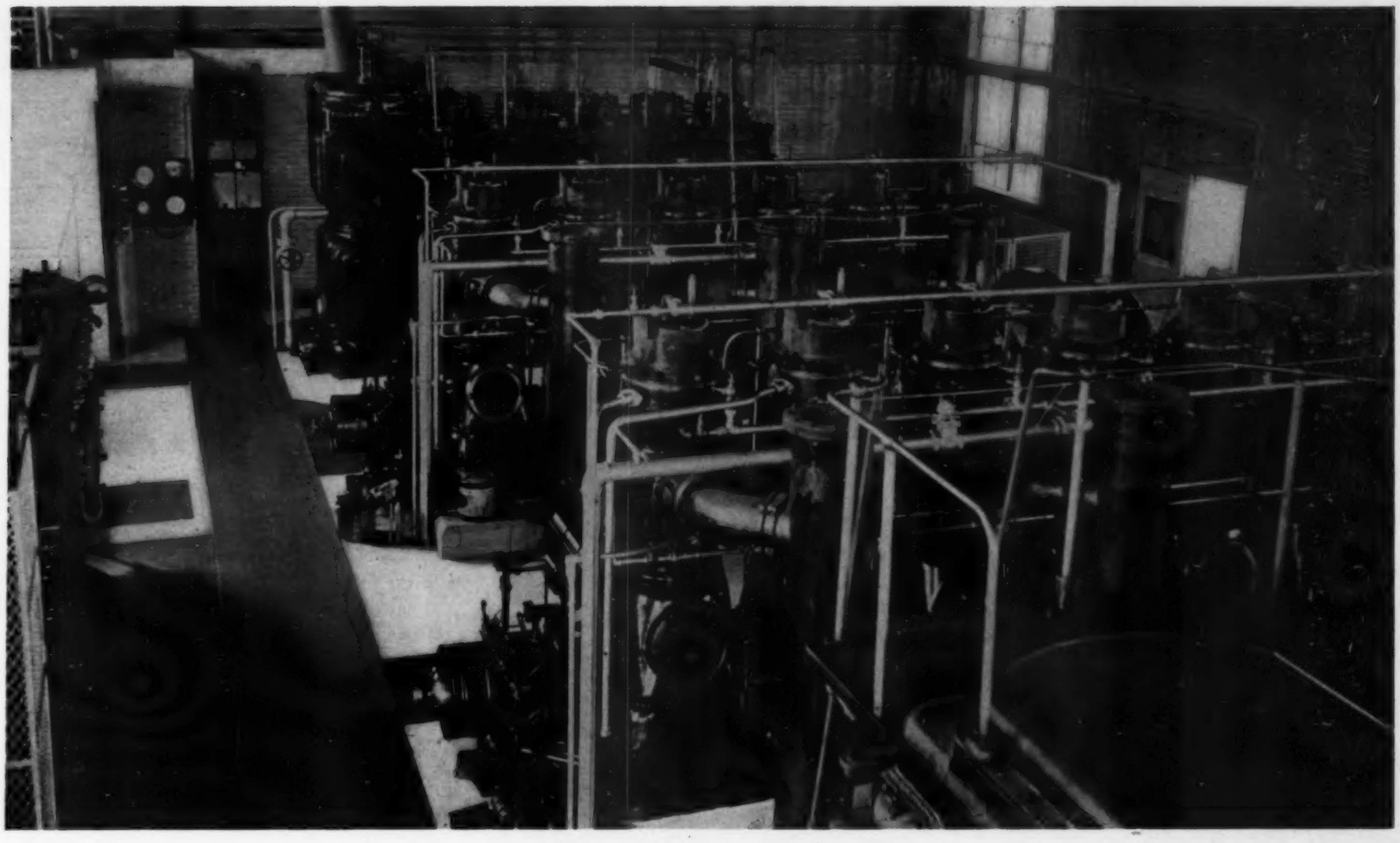
Last year 199,350 gallons of fuel oil were used at a cost of $8,934.66 to produce 1,916,350 kwh.; lubricating oil cost $1,079.98. Other expense, including a replacement fund of $6,144, brought the total to $21,048.51. Receipts for electricity were $43,869.71.

That the load is ever increasing is shown by the fact that the average monthly generation for 1935 was 17,000 kwh. over 1934 and for the first five months of this year was 10,000 kwh. monthly over that amount. With this continued increase it will be necessary in a few years to make arrangements to care for this greater load.

Within four years after construction the plant was loaded to capacity and the 135 kwh. unit was removed and a 700 hp., 465 kwh. Fairbanks-Morse unit was installed at a cost of $43,000. But the load continued to increase until it was necessary to run the new unit almost constantly and during the peak load to run one of the small original units to assist. This caused some concern, for something might go wrong and a shutdown would be necessary — for how long, no one knew. The two small units were not sufficiently large to carry the load. Another change was imperative.

In March, 1932, a 750 hp. Fairbanks-Morse unit was installed at a cost of $40,000. With this unit the plant now has the two original small units, the 700 hp. and the 750 hp.





The Fairbanks-Morse Diesel engines which made possible the interesting chart shown below. Lower left: Cameron's Diesel plant as seen by the casual observer.

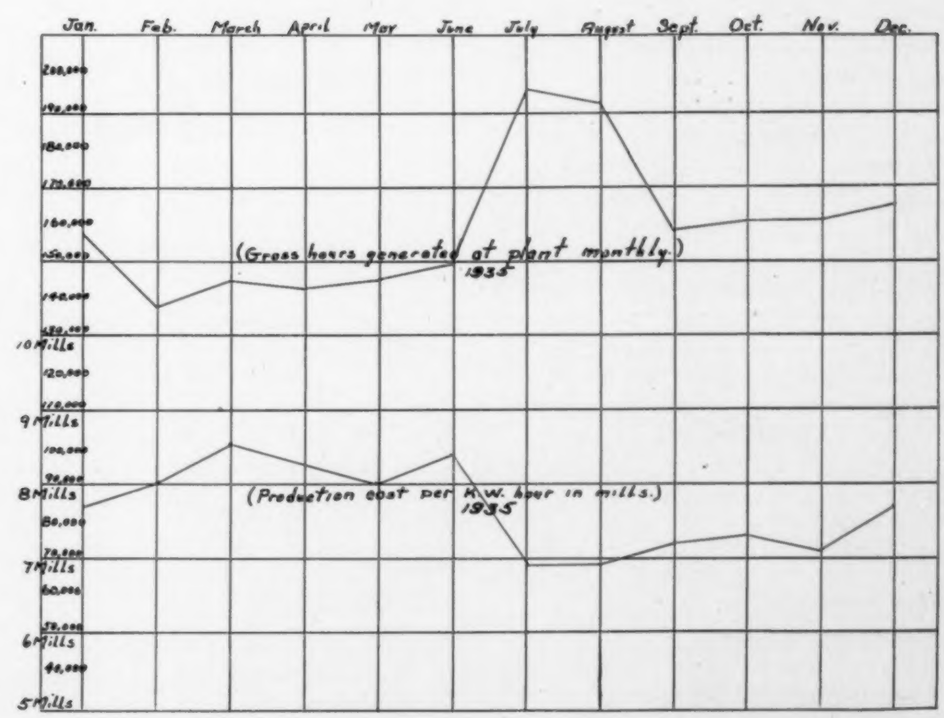
Repairs have been few and the cost small. In twelve years of operation the two small units have had new rings, two new pistons and four connecting rods, which, considering the hours run, has been extremely economical. The new unit has had new rings at a cost of \$155 and an extension shaft bearing at a cost of about \$45. It is planned to overhaul the 700 hp. unit, which has been used almost constantly this fall.

The cost of production in the old steam plant was around 4c per kwh. With the opening of the new plant this dropped decidedly and the first month cost of production was 1.1c. This cost did not vary much during the first years, but has declined recently until last year when the cost of production on the board was about .007c, which does not include allowance for depreciation.

With the lowered cost of production, rates to consumers could, obviously, be decreased. During the past twelve years this rate has been changed several times until the present schedule is:

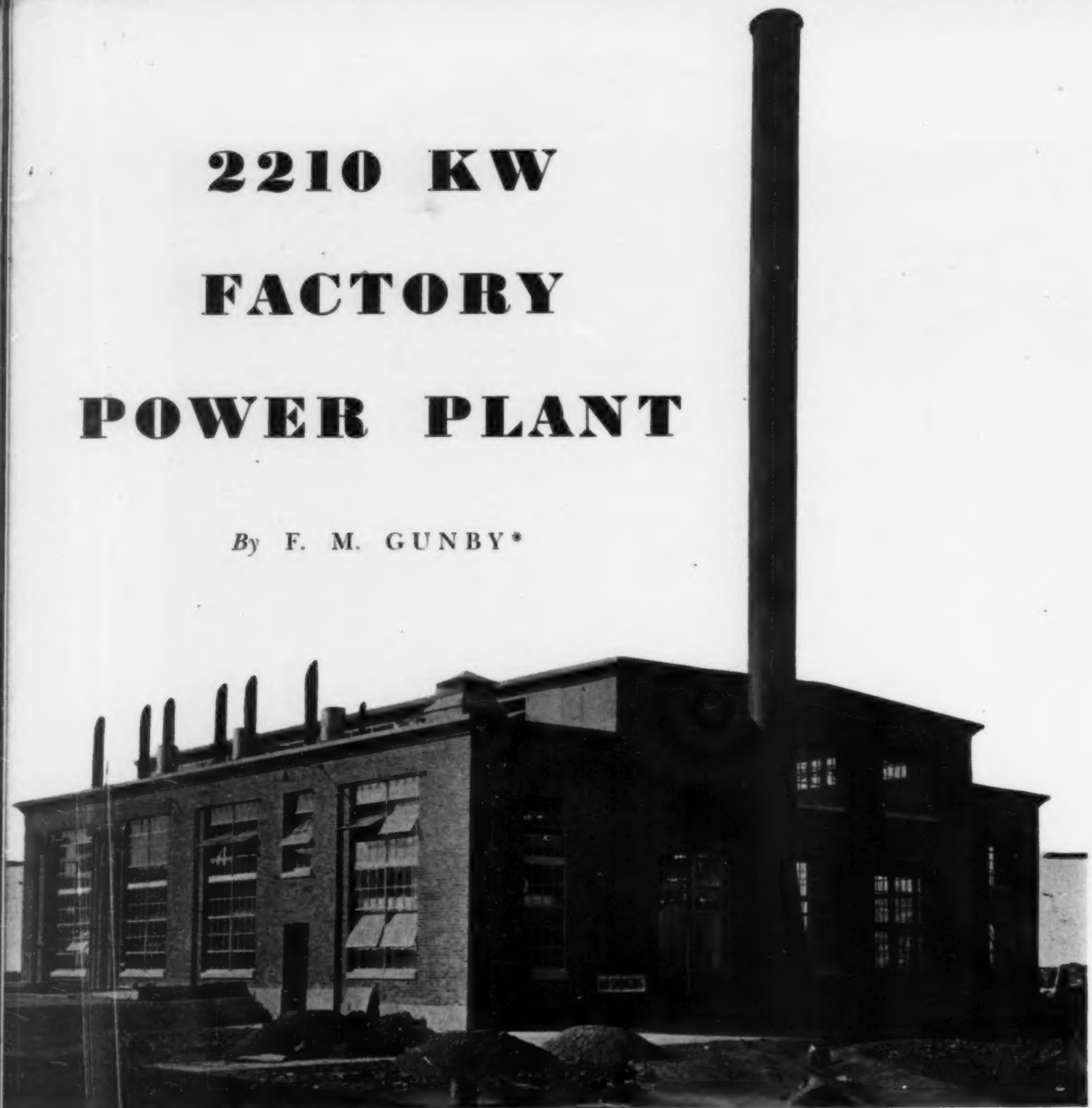
First 25 kwh.	.07
Next 25 kwh.	.05
Next 4,950 kwh.	.03
Over 5,000 kwh.	.02½

. . . . *And now please turn to page 59*



2210 KW FACTORY POWER PLANT

By F. M. GUNBY*



THE Ludlow Manufacturing & Sales Company have several plants in the United States and one in India. The power systems for these plants include water, steam and purchased power. For their latest plant at Edge Moor, Delaware, which is just going into service, the power will be generated by Diesel engines. Chas. T. Main, Inc., of Boston, has done the consulting engineering for these power systems, including that at Edge Moor.

At the latter plant the power house contains the Diesel engine units and also two small steam boilers for furnishing steam for process and warming the buildings. The boilers are oil fired and automatic in operation, and are in the same room with the engines where the same operators can look after both types of units. There is also an air compressor in this room.

The total installed capacity is 2,210 kw., which is divided among three main units of 700 kw. each, and a small 110 kw. unit to furnish light and power for Sundays, holidays, and when the mill is not operating.

The three main generating units are placed with center lines parallel in the central bay of a building about 74 ft. square. The bay is spanned by a 10-ton crane overhead, which can handle all of the parts of the engines or generators for maintenance work. On the northern side, beyond the central bay, is the switchboard and the electrical equipment, as well as the mill air compressor.

On the southern side, at the end of the engines, are the engine accessories and exhaust heat boilers, which are set on a mezzanine floor.

Across the eastern end of the station are the oil-fired high pressure and low pressure boilers, together with space for future boilers. The 110 kw. unit, with its cooling tower and accessories, as well as the steam heating return pumps and the boiler feed pumps, is also located there.

The arrangement of the principal features is shown in the accompanying plan. Such an arrangement concentrates the associated equipment and helps to keep the connections between them short. The span of the crane is reduced to a minimum. It provides support on the mezzanine floor for the exhaust heat boilers, engine tanks and accessories, which must be raised above the engine room floor, and it gives access, light and ventilation to all machinery and parts of the station.

The plant consists of three 1,000 hp. Winton Diesel engines, each direct connected to 700 kw., alternating current generator, 3 phase, 60 cycle, 600 volt, 225 rpm., with direct connected exciter.

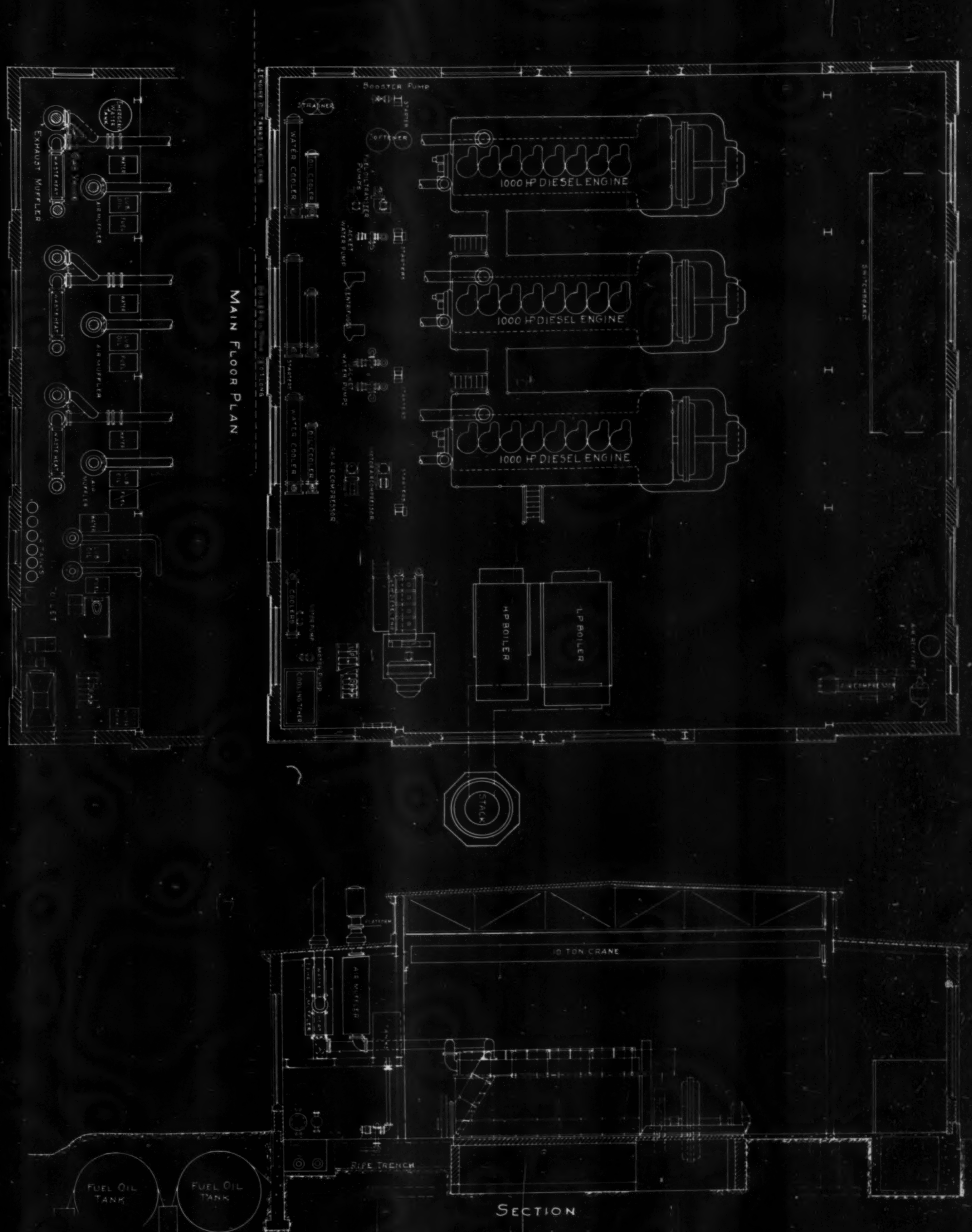
Each generating unit is equipped with a Woodward synchronizing governor of the latest type so that all engines can be put on the line from the switchboard. The switchboard contains the necessary generator and exciter panels, together with the feeder panels for the various parts of the mill. Each generator panel is equipped with its own voltage regulator. The generating equipment and the switchboard are of General Electric Company manufacture.

The main engines, of Winton standard design, are 8-cylinder, 4-cycle, mechanical injection type, in accordance with Winton latest stationary practice, and an attractive cast iron bedplate extends under the entire unit, thus insuring rigidity and permanent alignment. An inter-connecting inspection deck, with railing and convenient stairways, is provided. The small unit, which has 4 cylinders, is also provided with the same bedplate arrangement.

As this plant is located on the Delaware River, where the water is sometimes brackish, a closed cooling system for each of the engines has been installed. The raw water pumps are of the vertical type, so located at the edge of the river that they are always primed, and this

The balcony with one of the big Maxim Silencers in the foreground and two of the three Foster-Wheeler waste heat generators showing down the left hand side.

*Charles T. Main & Company, Consulting Engineers.


MEZZANINE FLOOR PLAN
EXHAUST MUFFLER
MAIN FLOOR PLAN
BOOSTER PUMP
STRAINER
SOFTENER
WATER COOLER
1000 HP DIESEL ENGINE
1000 HP DIESEL ENGINE
1000 HP DIESEL ENGINE
SWITCHBOARD
H.P. BOILER
L.P. BOILER
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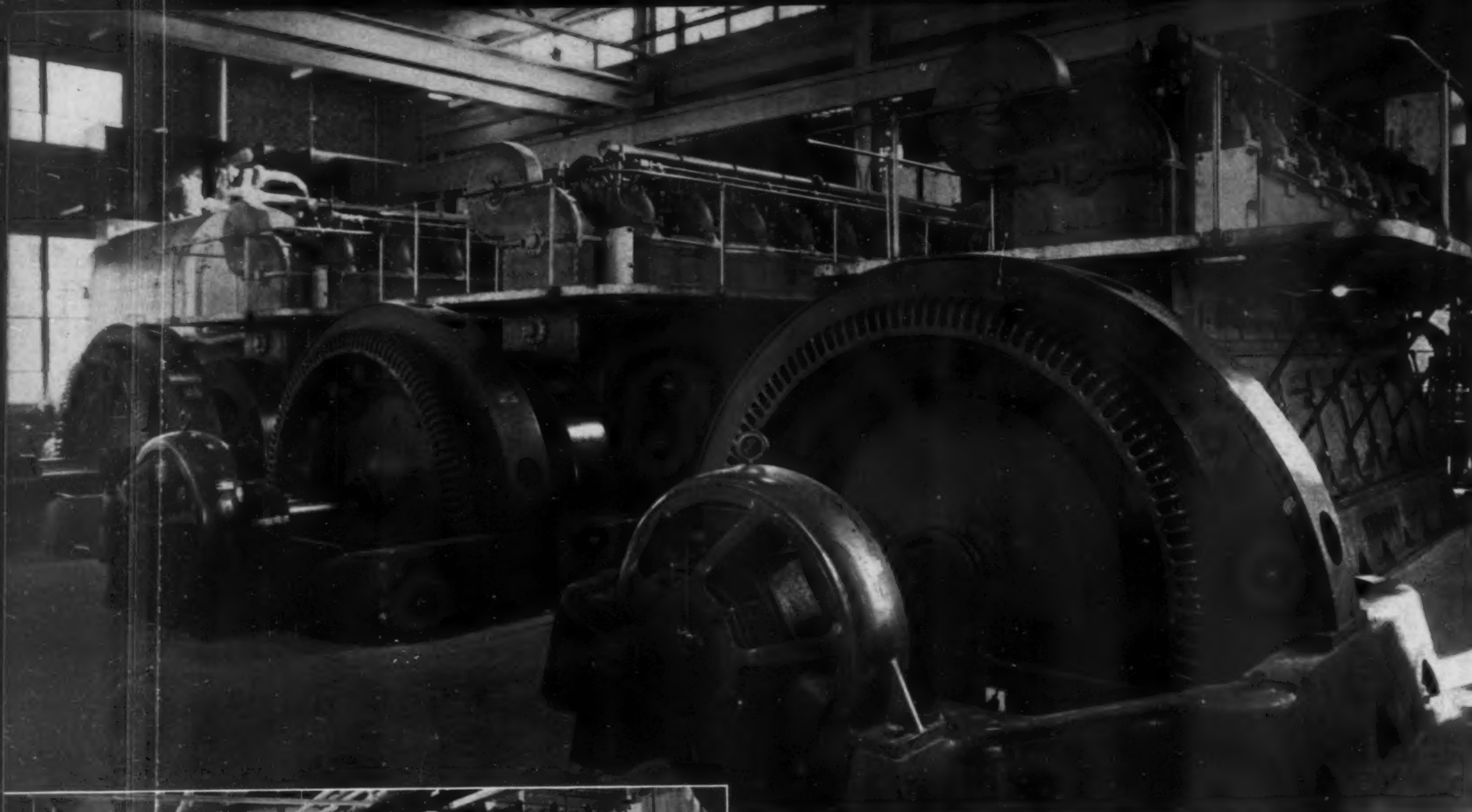
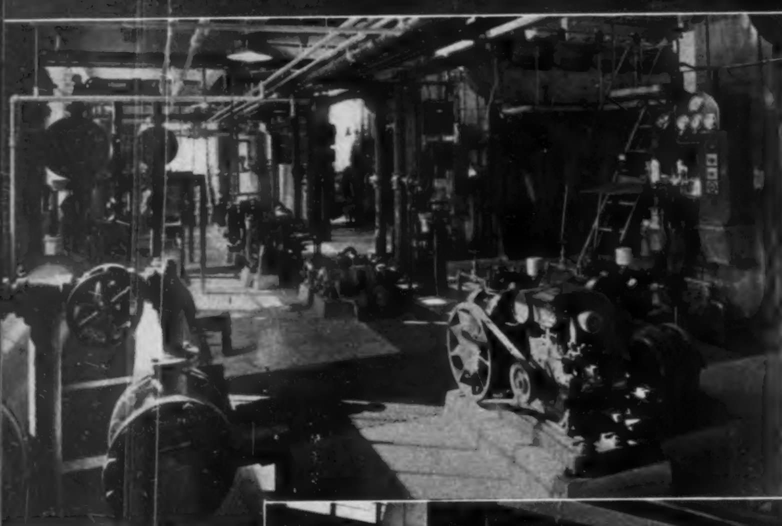
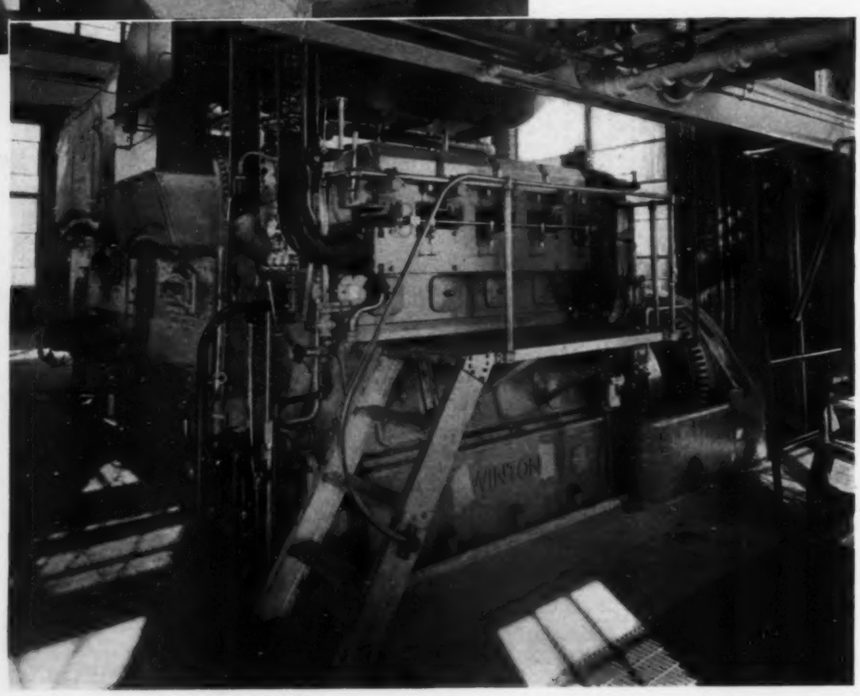






Generator view of the three main 1,000 hp. Winton Diesel engines.

The accessory aisle to the left. Two Quincy air compressors in right foreground, Ross heat exchangers in left foreground. Ingersoll Rand circulating pumps come next and behind them the two Hydroil Centrifuges.

The 165 hp. Winton auxiliary engine with the Kewanee boiler right behind it.

water is supplied to the various oil and water coolers of each of the main units.

For the small unit, which is to operate when the mill is not running, a cooling tower is provided in a corner of the power house so that it is unnecessary to run the river pumps in order to operate this small generator. However, because of the hard water used in the cooling tower, this small unit is also provided with a closed cooling system and the usual heat exchangers.

The Ross heat exchangers are all located above the floor in the southern bay of the building, and on this same floor are located the Quincy air-cooled starting compressors, one electric motor driven and one Wisconsin gasoline driven engine. The circulating pumps, Hydroil lubricating oil centrifuges and Roper oil transfer pumps are also located in this southern bay underneath the mezzanine floor.

On the mezzanine floor the water expansion tanks, the lubricating oil service tanks and the fuel oil day tanks are located directly opposite each of the main units. Also on this floor are the Foster-Wheeler waste heat boilers. The exhaust leads from each of the main engine headers to a Y and either out to the Maxim exhaust silencers and the risers above them, or through the waste heat boilers to the riser outside. Butterfly valves in each of these two branches, with a common control handle, determine which path the gases take. The boilers act as silencers for the gases flowing through them. The riser pipes lead up above the roof

line and are bevelled at the end to help the muffling effect. The intake air for each engine comes through a Staynew Protectomotor filter and a Maxim silencer, which are supported from the mezzanine floor, and thence into the engine intake header.

Fuel oil is stored in four outside underground tanks, and is pumped from any of them by either of the transfer pumps to the fuel day tanks on the mezzanine floor. The header which supplies these tanks has a riser on it with its top above the top level of the day tanks, so that when the tanks are full, this riser oil flows back into the storage tanks. There are valves in the return line which determine into which tank the fuel returns. Thus, the overflow returns to the tank from which it is being pumped.

Branches from the steam pipe header are taken to coils in each day tank so that the fuel may be heated if necessary. Each engine has its own day tank and the fuel flows from it through a fuel oil meter to the injection pump on the engine by gravity.

There is also an outside fuel oil storage tank for the oil for the steam boilers, which use a heavier fuel than the engines.

Lubricating oil for each engine is pumped from the engine crankcase by an attached pump and delivered to the service tank on the mezzanine floor, from which another pump takes its suction and delivers through the Ross cooler to the engine full pressure lubricating system. The oil from an engine is cleaned by running it through the Hydroil centrifugal purifier which has its own pumps for handling the oil. Suction is from the service tanks and the clean oil is delivered back to the same tank. Each engine has its own complete lubricating system. There are two centrifuges so piped that the oil from two engines at a time may be cleaned without danger of mixing oil from one engine with that from another. Both fuel and lubricating oil passes through Purolator filters.

The cooling water system is of the closed type. The soft water from the engine jackets overflows to the surge tank on the mezzanine floor. The Ingersoll-Rand circulating pump takes its suction from this tank and discharges water through the Ross heat exchanger to the engine jackets. Each engine has its own soft water cooling circuit, but there is a common raw water circuit for all three of the main engines.

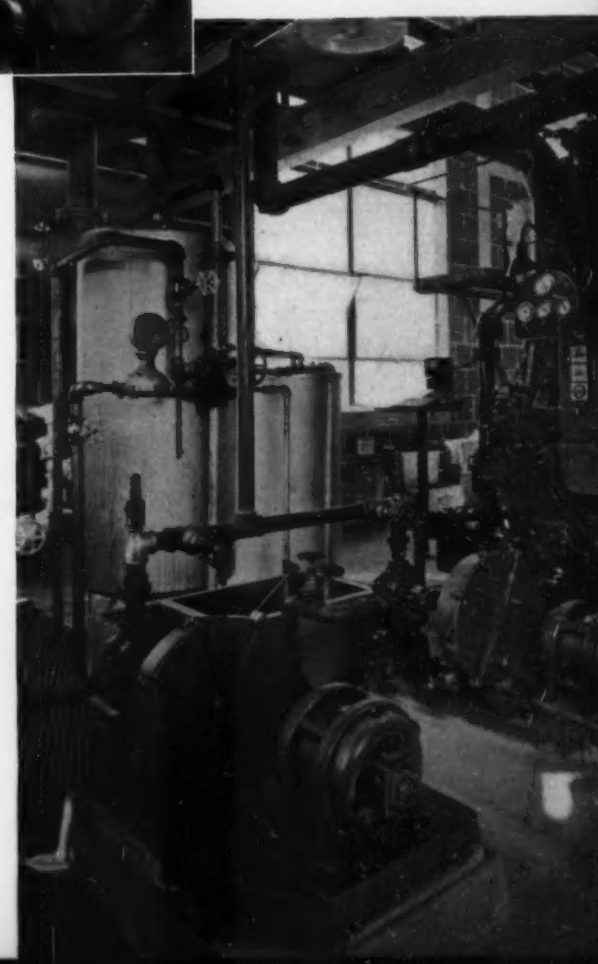
The domestic and manufacturing water for the mill is supplied with pure water from deep well pumps. This water is stored in two elevated tanks, one of which serves for fire sprinkler service, and the other for domestic service. The make-up water for the boilers, engine jackets, and certain other purposes, is taken from this latter tank through a Permutit zeolite softener.

On the west end of the mezzanine gallery is located a 400-gal, service tank, ordinarily kept full by the raw water pumps at the river. However, there is a novel arrangement of float valves so that should the raw water pumps stop, or the Andale duplex strainer become clogged, the domestic water from the elevated tank flows into the raw water system and an alarm notifies the operator. The vertical Worthington raw water pumps at the river are several hundred feet from the power plant and operate without attendance. They are started and stopped from the main switchboard and their operation is indicated by a simple system of lights with an alarm bell.

The small 165 hp., 4-cylinder unit is a complete, self-contained installation. It is direct connected to a 110 kw. General Electric generator with direct connected exciter, and is equipped with Woodward synchronizing governor so that it may be run in parallel with the main units. It has its own fuel, lubricating oil and cooling water system with tanks and pumps and a cooling tower, which is located inside of the station building, but the vapor is discharged at the top through a short stack to out . . . . *And now please turn to page 54*

General Electric switchboard with Telechron electric clock frequency control at top left.

Control station of one of the main engines showing Woodward governor, Purolator oil filters and Alnor pyrometer.



Roper fuel transfer pumps with Permutit water softening unit in background.

DIESEL PROGRESS IN JAPAN

By HERBERT LEOPOLD

Tokyo Correspondent

DIESEL engines are not new in Japan. They are now being produced for practically all purposes, except for pleasure car and airplane. They are still in an experimental stage. By 1940 Japan's Diesel line is expected to be complete.

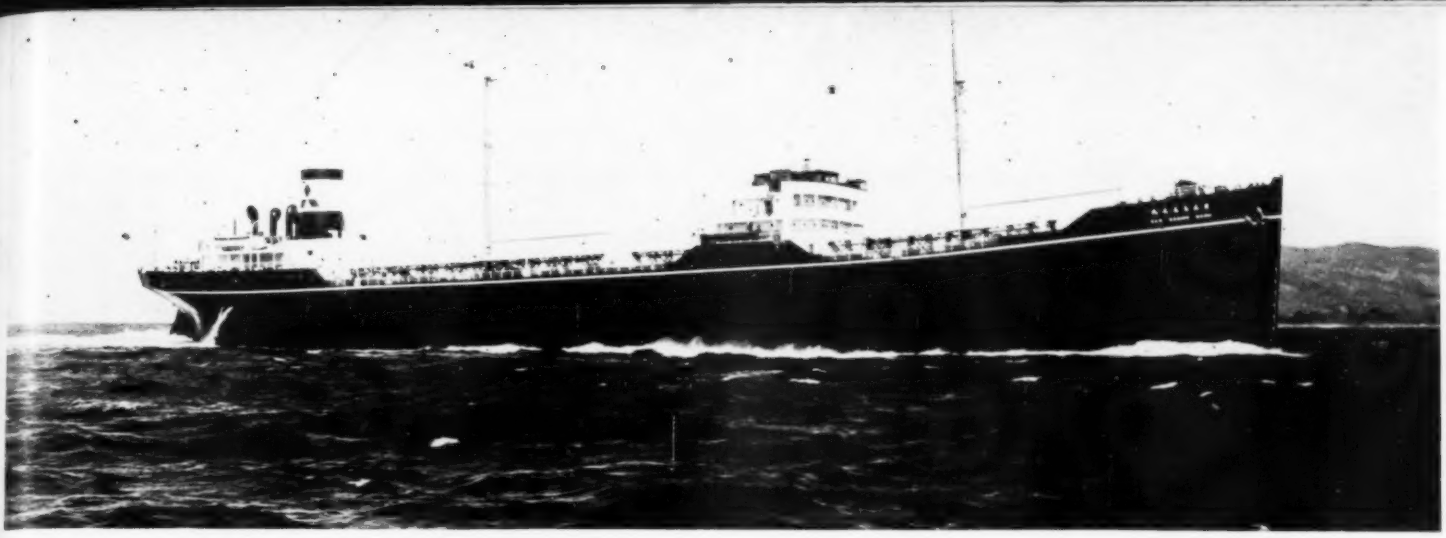
Japan has a total of 110 motorships. Of the Diesel engines installed in these ships, only 29 were imported from abroad, and all the other manufactured by local makers, though partly under royalty to foreign designers. Single-acting two-cycle engines are preponderant, numbering 42 units with a combined output of 203,000 bhp., and single-acting four-cycles total 37 with 80,930 bhp.

Among the foreign makes, the Sulzer Diesel engine enjoys the greatest popularity, the Burmaister & Wain is a good second and the M.A.N. comes next.

A quite recent outstanding development is the powerplant of the tanker *San Ramon Maru*. It is a single-acting, two-stroke and airless injection engine. It has five cylinders, each with a bore of 720 mm. and a piston stroke of 1,250 mm., and develops 3,300 bhp. at 125 rpm. Cooling water and fresh water for the pistons is supplied from two centrifugal pumps. The oil piping employs the principle of the cross-over system.

The first double-acting unit ever built in Japan is installed in the motorship *Akagi Maru*, which was launched early in September from the Nagasaki dockyard of the Mitsubishi Heavy Industries, Ltd. It is designated as 8 MSD 72/120 type engine, which abbreviation stands for eight-cylinder Mitsubishi-Shimizu (the designer) Diesel engine with a cylinder bore of 720 mm. and a stroke of 1,200 mm. This unit develops 8,000 bhp. at 110 rpm.

As a means of meeting motorcar competition, Japanese railroads have turned in recent years to the use of internal combustion engines as prime movers for electric power generation. With Diesel locomotives and railcars they are providing speedier and more frequent service more economically, especially where short distance and less crowded passenger hauling problems are encountered. Another field for Diesel application is found in Manchuria, where drought and severe coldness are obstacles to the operation of waterfed railroad vehicles. The South Manchuria Railway Company operates successfully 500 hp. Diesel-electric trains, consisting of a railcar and three trailers. Though oil is scarce and expensive and coal abundant and cheap, Diesel vehicles are quite a paying proposition, because there is no outlay for water feed arrangements. All of the cars operated by the S-M-R are powered by six-



cylinder Niigata units, having an output of 500 hp. at 850 rpm.

Two locomotives powered by Niigata 750 hp. at 650 rpm. Diesels as prime movers have been recently acquired by the South Manchuria Railways and are said to be performing creditably.

As for Japan proper, the Sagami Railway Company two years ago adopted the Diesel principle on its line. But an imported engine, the Junkers 54, was installed in the "Kiha" type railcar. Now home-produced Diesels of similar dimensions are used. Another type of Diesel-electric car was put into service on the Kita Kyushu line.

Recent developments in the high speed field include the Mitsubishi, Ikegai, Niigata and Hitachi engines for bus and truck. Mitsubishi comes in two types, 445 AD and 650 AD.

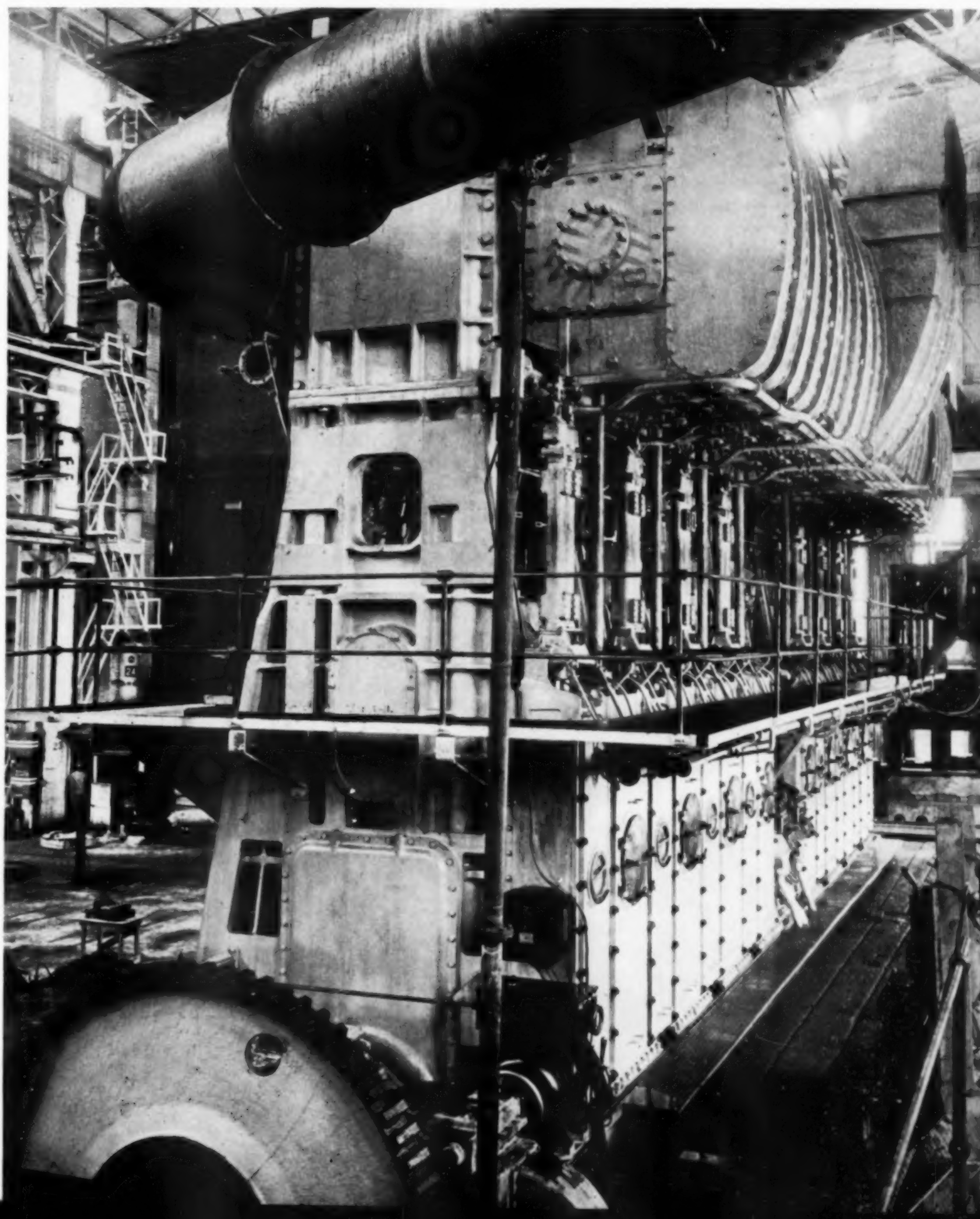
Their main specifications follow:

Type	445 AD	650 AD
Cycles	4	4
Cylinder bore (mm)	115	105
Cylinder stroke (mm)	150	130
Number of cylinders	4	6
Total displacement (litre)	6.2	6.8
Horsepower at 1,400 rpm.	45	50
Maximum hp. at 1,900 rpm.	65	70
Fuel consumption rate gr/hp/hr	175	180
Weight per hp. (kg)	6.15	6.4

A special feature of these engines is the fuel pump, which is of remarkably small size. It is designed so as to make the injection quicker when the volume of the fuel is increased. It is protected by a Mitsubishi patent.

More or less in the experimental stage is another Mitsubishi type designated as SHT-6 Diesel engine, which employs the pre-injection principle.

The Diesel developed by Ikegai is an airless injection type. In 1934, a special fuel chamber was designed so as to make combustion smokeless. It is now generally adopted with satisfactory results. There are two sizes, 4 HSD 10 of 40 to 50 hp. at 1,500 rpm. and 100 x 140 mm. cylinder dimensions. The other is 6 HSD 10, of 60 to 70 hp., and the dimensions of its six cylinders are 100 x 140 mm. A design said to be based on the German AEG Diesel has been announced by the Niigata Iron Works. It is a 50 hp. four with 100 x 125 mm. cylinder dimensions, the shortest type made in Japan and, incidentally, the lightest Diesel motor on the market. With a total weight of 382 kg. its hp.-weight ratio is the lowest among all Japanese makes.



One of Japan's contributions to the field of large Diesels — an 8,000 bhp. Mitsubishi-Shimizu engine — installed in the M.S. "Akagi-Maru."

All the aforementioned manufacturers are busy on their respective plans to build Diesel-powered passenger cars.

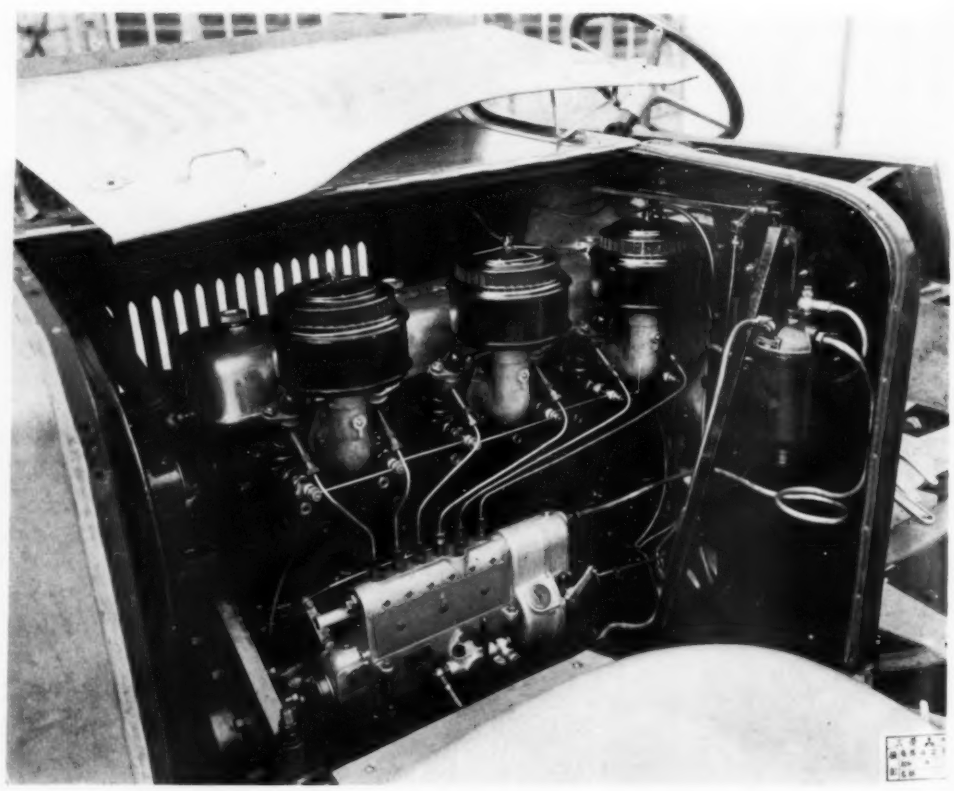
The Hitachi Limited, Tokyo, recently announced its intention to market on a large scale a Diesel truck with new fuel economizing characteristics. Details are unavailable as yet.

Presumably to meet the Japanese Army's tractor ideas, machine tool makers Ebara Seisakujo K. K. (Ebara Manufacturing Works, Ltd.) have gone into tractor making. The Ebara caterpillar has a net shipping weight of 4,000 kilograms.

The engine is a four-cylinder, four-cycle Ebara Diesel of new design, details of which are not yet available. There is no starting engine, it is understood. Before the proper operating heat is reached, a fuel of higher volatility than that of the low grade fuels for which the engine is designed, is fed from an auxiliary tank to the carburetor. The engine develops a maximum output of 45 hp. The drawbar horsepower is rated at 28 units, and the belt horsepower, which is obtained from a pulley mounted on the rear is 34 hp.

Japan is thus making Diesel progress comparable with her occidental neighbors.

As in the marine and railway fields, Japan is also making Diesel progress with the automotive type engine. The Japan of the rickshaw seems to be a thing of the past.



DIESEL OIL WELL DRILLING

By CHARLES F. A. MANN

THE possibilities of finding oil under the vast lava beds of Central Washington State have long intrigued the petroleum industry. Almost the entire region lying east of the Cascade range and west of the foothills of the Rocky Mountains in Washington is one vast lava bed, the upper layer of which is the rich, decomposed lava and volcanic ash soil that makes the Big Bend wheat country and the irrigated valleys in the Western part world famed agricultural areas. Ever since the West was first prospected for oil some fifty years ago, the possibilities of a great oil pool lying under the Columbia River Basin desert have been a strong lure to oil men.

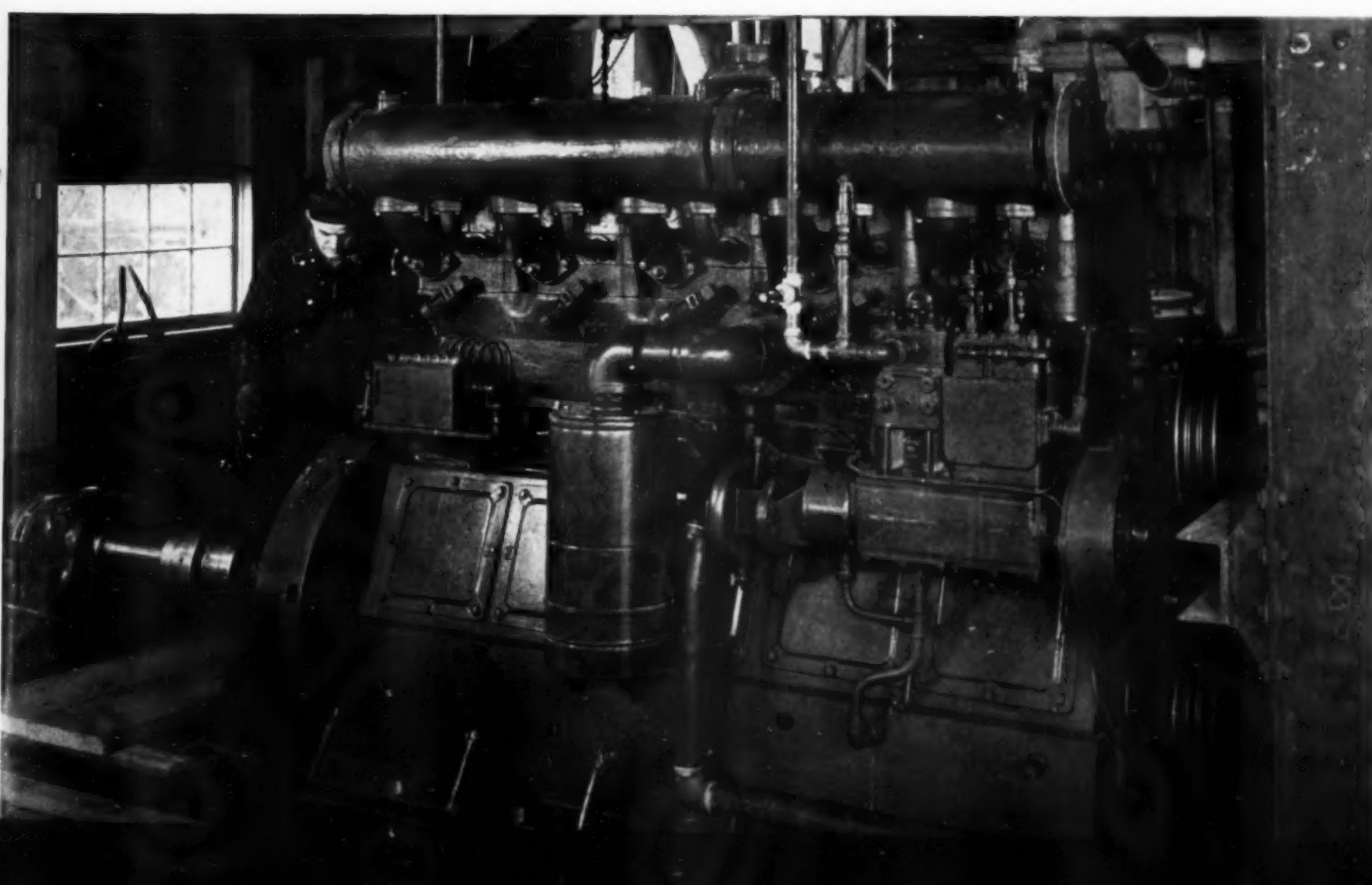
The Columbia Basin is the vast saucer formed in the east central part of the state, encircled on three sides by the mighty Columbia River. Protecting peaks of the Cascade Range lying to the westward reduce the 50 to 100 inch coastal rainfall to a scant 5-9 inches, mostly in the form of snow in winter months, barely enough to support the most meager desert growth. Sagebrush and jackrabbits are the Basin's principal crop.

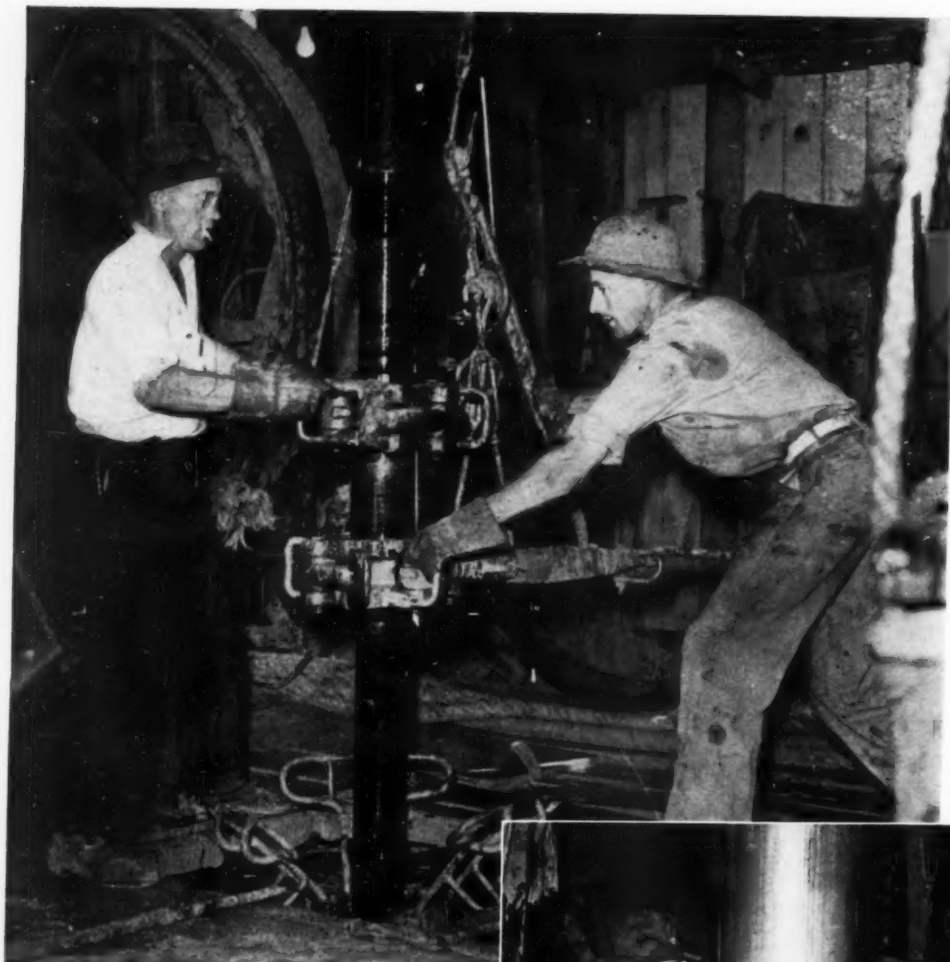
It has remained for the People's Gas and Oil Company and its operating subsidiary, the People's Gas and Oil Development Company, to tackle the problem of cutting a mile deep hole through the lava beds in the Frenchman Hills section of the Basin, lying near the Milwaukee Railroad in Grant County. The site of "Donnie Boy No. 1," as the well is named, lies in the center of a 135,000 acre tract, owned outright by the parent company. A semi-cooperative venture, the site of the first well is unique in that the well is being cut on lands actually owned by the same company. Thus by control-blocking the entire area, a soundly conceived plan of development is possible, which will permit economic development of the entire field.

Dr. H. H. Meyers, Petroleum Geologist of the People's Gas and Oil Company.

Only two or three other oil fields in the world have ever been developed in basaltic formation, the one in the Malay States and one in Mexico, both having blown in as the largest single oil wells ever known. Geologically the region is of such character as to make the conventional steam-drilling system almost impossible. Expensive rotary drilling equipment operated by high-powered machinery is necessary to penetrate the successive layers of basaltic lava and reach down to the cretaceous beds. As there are approximately 12 successive lava beds to penetrate, the unusual "shot-drilling" system was adopted, which uses hardened steel shot ground into the periphery of a large steel barrel in place of black diamonds. The unusual size of the hole, 16 inches, made the cost of diamond-drilling prohibitive, so the slower but less expensive shot-drilling setup was adopted. The steel barrel is rotated at the bottom of the hole, cutting a rock core which travels up inside the descending barrel, or drill-bit. After a time the core is hoisted out of the hole by means of the derrick and the process of feeding steel shot to the outer

The original five cylinder 165 hp. Atlas Diesel, first of two installed at the "Donnie Boy No. 1" to supplant steam equipment.



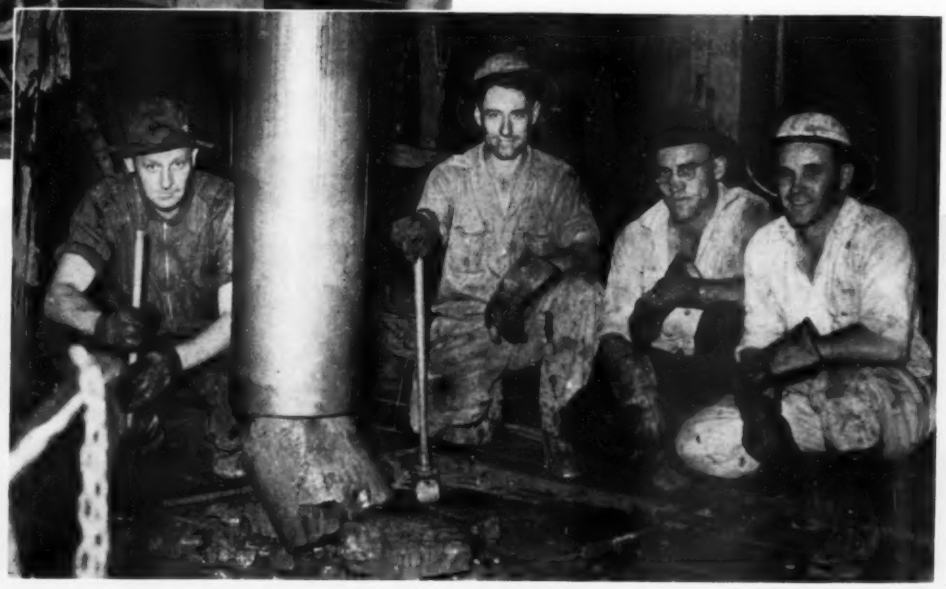


edge at the bottom of the hole is begun all over again.

The 16 inch hole is the largest ever attempted in basaltic formation, and because of the great depth to be penetrated, an unusually complete camp was set up, with the latest and most expensive equipment installed, preparatory for a three-year continuous night and day run if necessary. With unusual financial backing, the project will be kept going until the last foot of rock is penetrated, and for this reason all equipment is of the heavy duty variety.

The derrick and camp are located in the desert, 147 miles from Seattle and 43 miles from the nearest habitation; 240 miles from fuel oil delivery and 1,200 miles from oil field equipment stores. More than 2,500 tons of equipment was moved over desert roads, including three Diesel engines and all drilling gear.

Shot-drilling with Diesel drive at the "Donnie Boy No. 1." Left: Placing the casing. Below: Hollow steel drill bit which forces the shot against the rock face to form the bore as indicated



At the start a temporary steam drilling gear, with standard cable operation was used. Disregarding the cost of power generation from an oil fired steam boiler, intermittent operation resulting from this system made it necessary to fit up a higher powered operation to be set up to permit continuous high-speed operation. The boiler consumed 15½ barrels of oil at a delivered price of $2.20, with 60 hp. available. The steam plant was replaced by the latest type rotary drilling rig, together with chain-driven hoist and slush pump, using an elaborate system of clutches and reduction gears. The new gear is driven by two Atlas Imperial four cycle Diesels. The first engine, installed when the upper rock was encountered, is a five cylinder Atlas Imperial Diesel, having a 9 inch cylinder bore and a 10½ inch stroke, developing 165 hp. at 500 rpm. As the load increased, another Atlas Diesel was installed, identical in every respect with the first, but having 6 cylinders and developing 200 hp. Both engines have self-mounted radiators and are arranged for tandem drive, with separate clutches. A 16 x 16 inch Wilson-Snyder slush pump, driven through a 5-1 reduction gear and chain drive is also fitted in the assembly.

In the opposite end of the power house is a large drum and cable hoisting plant to withdraw the drill cylinder and handle casing for lining the well as the drilling progresses. Because of the great depths involved the hoisting gear has shafting 8½ inches in diameter. The Atlas Diesels are of the common-rail injection type, have individual gasoline engines for starting and are mounted on heavy skids.

With 365 hp. installed, the operation of the 16 inch drill and hoisting mechanism is easily and quickly handled. As the depth increases the basalt becomes tougher, due to the tremendous pressures under which it is solidified. As basalt is a non-crystalline rock, it is very difficult to cut, and when the operation becomes a matter of twisting a 16 inch drill shell against rock at the bottom of a hole 2,000 feet deep, the reserve power of this tandem power plant will be entirely utilized.

After changing over to the shot-drilling system and Diesel drive, the fuel consumption dropped to 7½ barrels per day, at a cost of $2.45 per barrel delivered. Due to the high cost of freight there is little difference in the price of boiler and fuel oil when received at the site.

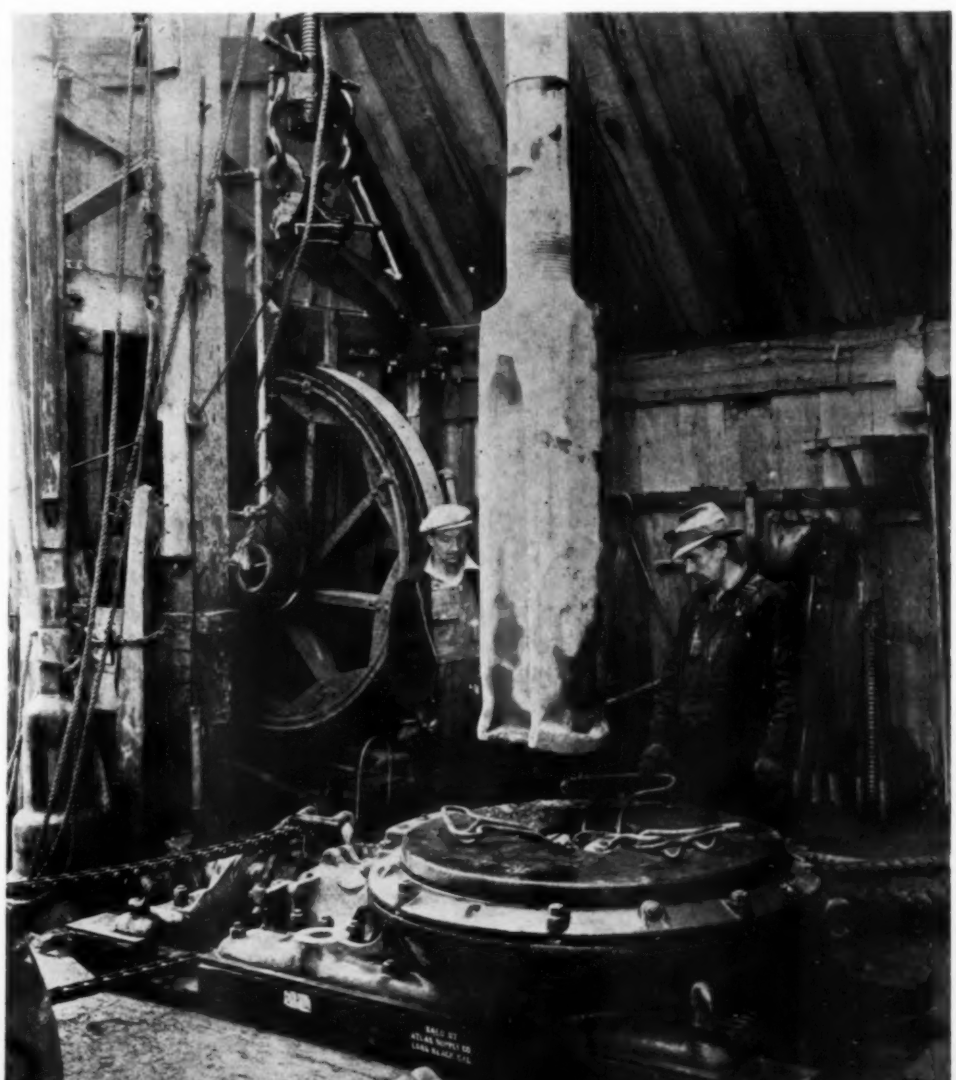
A 20 hp. Fairbanks-Morse Diesel generating set is coupled to a 15½ kw. generator, which supplies all the electricity for lighting, crew's bunkhouse and cooking. It is interesting to observe that the fuel bill was halved owing to the substitution of Diesel power, yet the available horsepower jumped from 60 to 365. Reduced heat losses, due to the fact that the boiler had to be away from the scene of actual drilling, is responsible for part of this saving.

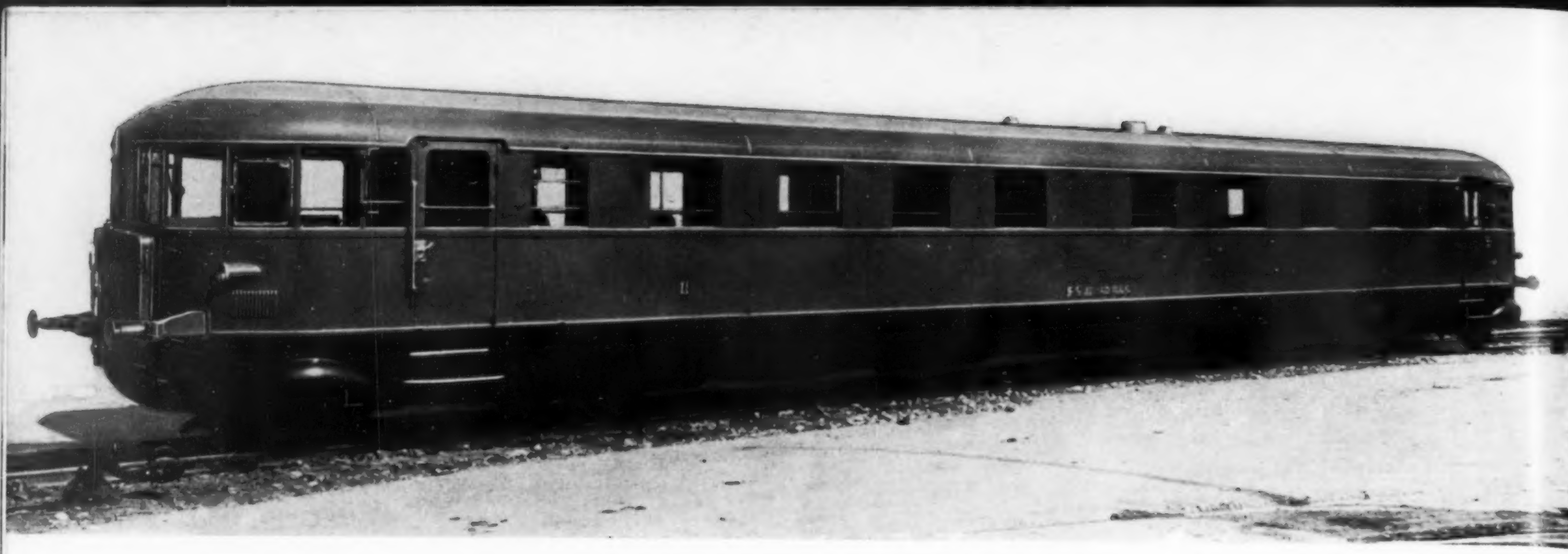
A four-day dust storm in June was successfully weathered without a minute's shut-down. Some of the exposed journals on the shafting had to be steamed out and fresh lubricant applied to rid them of the abrasive sand. The engines were equipped with large air filters and came through in fine shape.

Large fuel storage capacity was necessary because only a full tanker-trailer could be delivered economically. This consists of a 12,500 gallon tank and another of 10,000 gallons capacity, each with a steam pump and a heater for unloading. A gasoline driven pump brings fresh water from a 500 foot deep well to the 5,500 gallon drinking water storage tank and a 100 ft. x 8 ft. concrete tank supplies the brackish desert water for use with the rotary drill.

"Deep Hole" oil men from California and Persia are watching this development with keen interest because it marks a new departure in fast, economical drilling in rock formations that will have world-wide application elsewhere.

Special work requires a rotary drill, chain driven from the Atlas Diesel, and a cast iron rock-smashing bit.



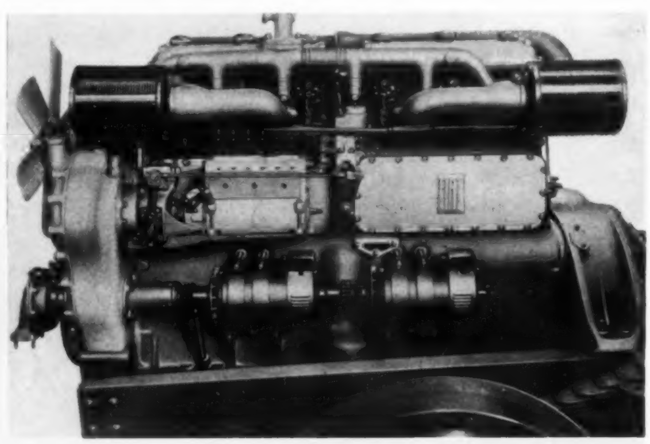


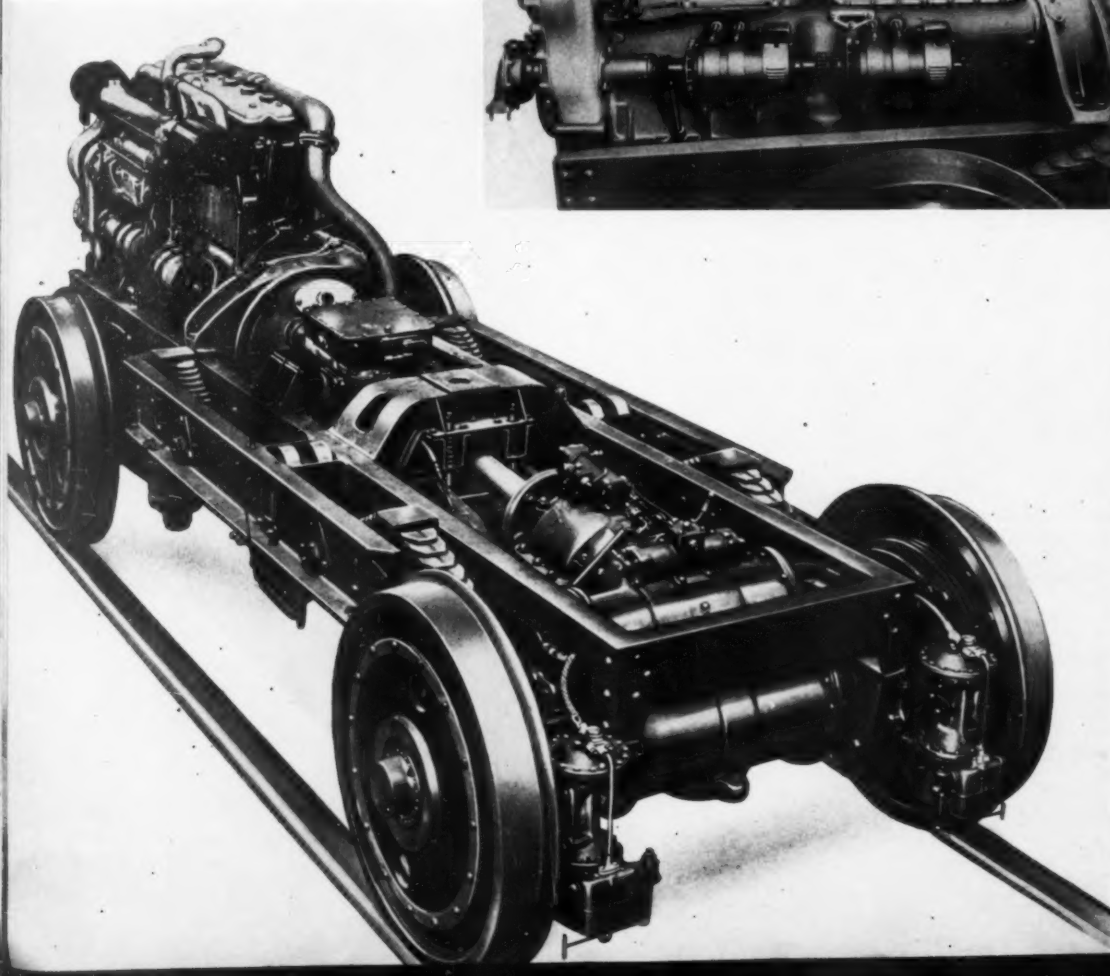
DIESELS IN ITALY

By ANTONIO GIORDANO

THE Diesel engined rail cars which are employed since two months ago on the express train service which insures the connection between Milan and Venice belong to a set of 25 rail cars built by the Railway Rolling Stock Department to the order of the Italian State Railways Administration. It is claimed that such rail cars are the last word in Diesel traction cars. Milan-Bologna-Verona-Venice and Bolzano are now connected by services undertaken with these cars. The construction of the body is of the tubular structure type in steel. Thus has been obtained a light and resistant body which could not be had with the past systems of construction. In regard to the interior passenger accommodations it may be noted that on a breadth of 2,700 m/m. are arranged three passengers of whom two are in two comfortable coupled arm chairs, and the third in a single arm chair separated from the other two by a corridor running the whole length of the car. First and second class are provided. The first class can accommorate 17 passengers and the second class 23 passengers. The central part of the car is occupied by the kitchen fitted with a refrigerating plant for the preservation of food, and with a gas cooking plant. At the two ends of the car, in addition to the driver's cabins, engine room, etc., there are, on one side, the mail room and the baggage room, and, on the other side, the toilette and another room for light baggages.

Fiat Diesels are setting the pace of railway progress in Italy.





These cars are driven by two 357 Fiat Diesel engines of 145 hp. each allowing the car to reach a maximum speed of 130 km/hr. at full load, and allowing the coverage of the distance between Milan and Venice in 2 hours and 40 minutes at the service speed of 100 km/hr.

These cars are employed also on the following railways: Palermo-Messina, Palermo-Agrigento, Messina-Siracusa, and Roma-Ancona. The employment of these Diesel engined rail cars has allowed the Italian State Railways Administration to reduce greatly the time employed in covering the distance between the various . . . . *And now please turn to page 54*

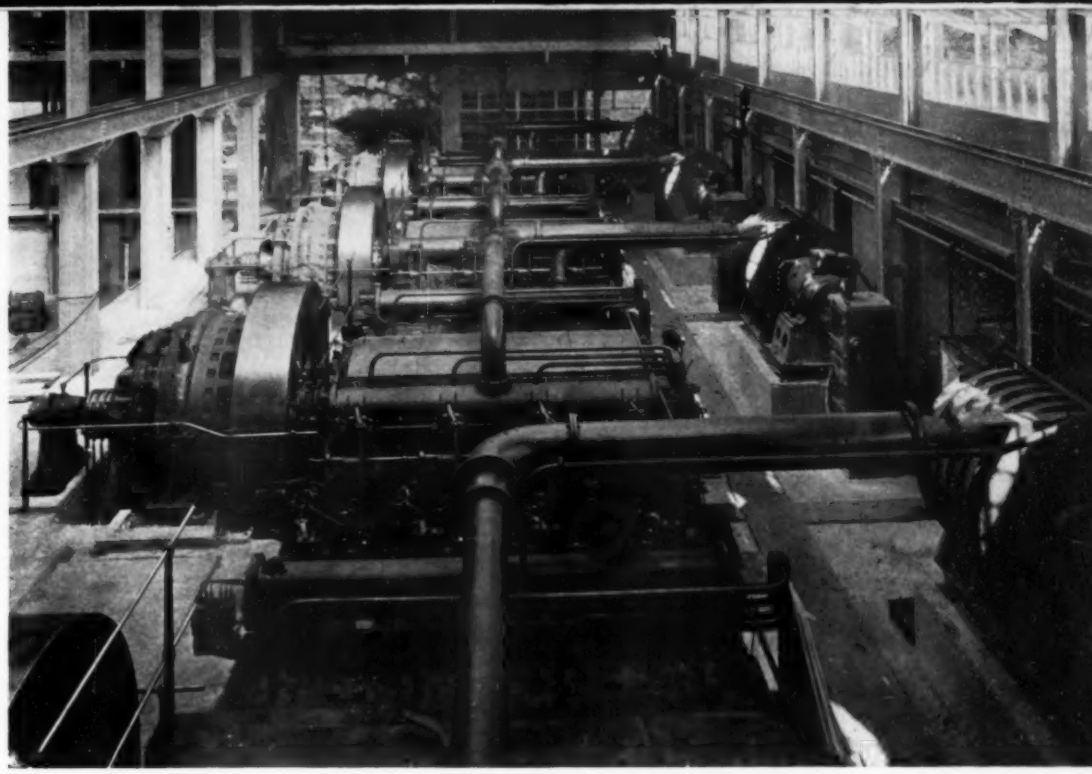
LONDON LETTER NO. 13

By GEORGE LIND

IF one were to ask that legendary figure, the "average Englishman" just what British industry had made the greatest progress during the last five years he would undoubtedly answer "the films." Even in the States, ancestral home of screen production. The re-vitalized British film industry is now talked of with respect. As is only to be expected with a developing industry, new and larger production plant is constantly having to be laid down — and this is where the Diesel engine plays an important part. Since 1933 five great new film studios have been opened on the outskirts of London alone, and in everyone of them Diesel engines are used for power generation.

Film production is a tricky and varying business in which spells of tearing activity are succeeded by "playing" periods, when the power demands fall to a few kilowatts. It is this continuously fluctuating load which makes the Diesel the only practicable power producer for screen work.

Apart from Diesels, the two alternatives are mains electricity and steam turbine-driven generators, the leading disadvantages of which are given below —



Cinema Diesels! These 1,100 bhp. Crossley-Premier Diesels furnish power to the Denham Studio of the London Film Production Company. Attention is directed to the separate blower units.

Photo from "The Oil Engine"

The cost of mains electricity would be prohibitive on account of the low load factor (between 5 and 10 per cent usually) and the high maximum demand.

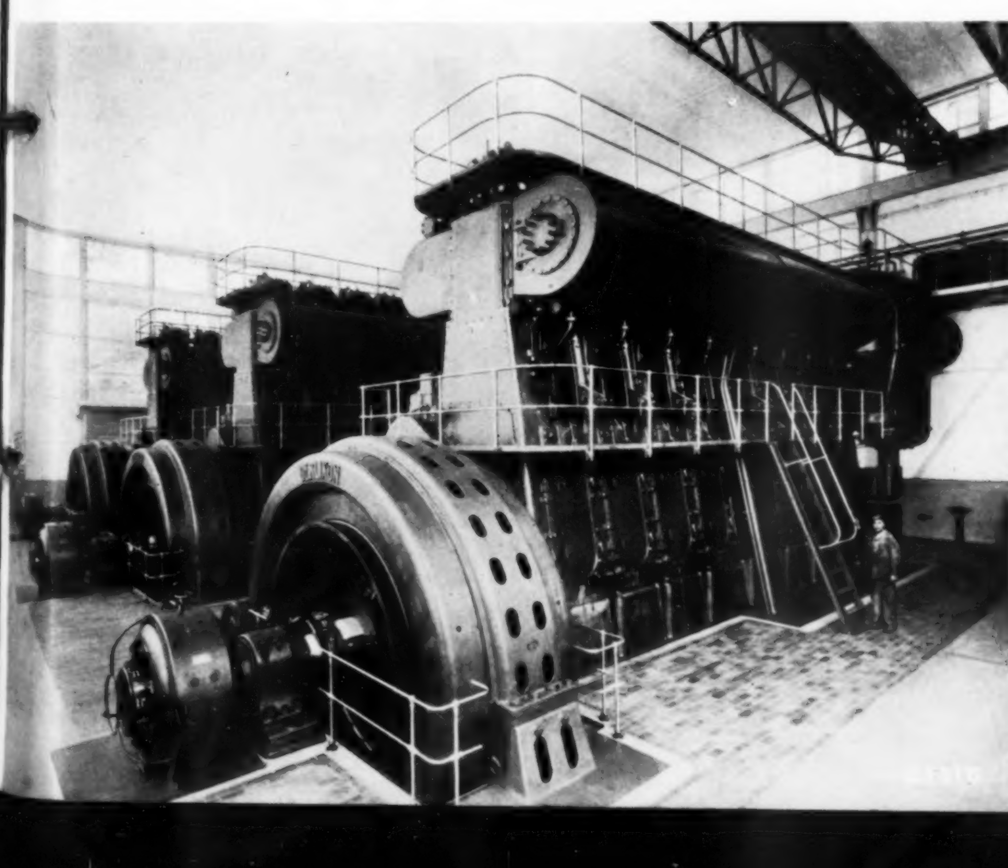
The capital outlay on equipment suitable to convert incoming alternating current to D.C. of the required character would be greater than the cost of a Diesel installation, bearing in mind the necessity for an alternative supply in the event of a mains breakdown.

The load fluctuation would make a steam turbo-generator set highly uneconomical, the turbine being an efficient machine only in cases where the power demand is roughly constant and the speed variation small.

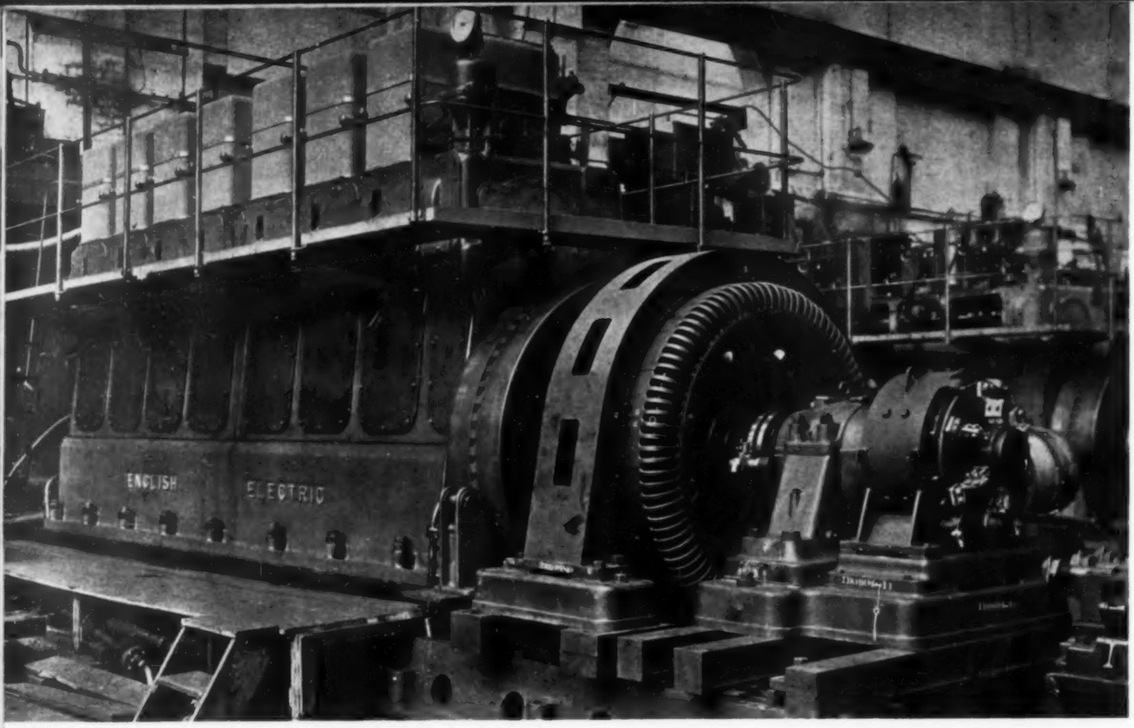
Turning now from generalities to facts and figures here are some particulars of one of the newest and finest British studio installations. The plant is owned by London Film Productions, Ltd., of whom Mr. Alexander Korda is chief producer, and is situated about 25 miles out of town. It was completed in June, 1936, and has the distinction of being Britain's largest private Diesel installation. In passing, it might be mentioned that the building of the studios and general constructional work were in charge of that genial little American, Mr. Jack Okey.

The engines chosen for this station were Crossley-Premiers, all of the same power and direct coupled to 763 kw. generators. To American ideas these engines must be particularly interesting, as not only are they horizontally opposed eight cylinder 4 stroke airless injection units, but they are pressure charged and develop 1,100 bhp. each at 250 rpm. Six engines are at present in action, giving a total of 6,600 bhp. and space has been left for a further pair on one side of the power house.

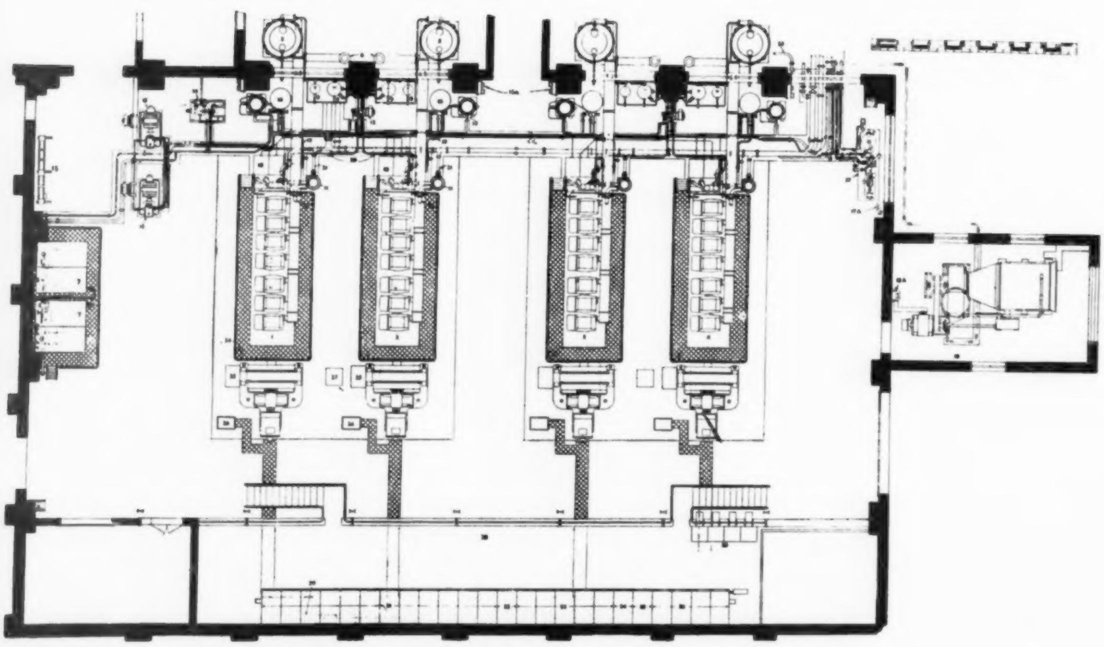
Each engine has a separate waste heat recovery plant comprising a Spiralflo twin-shell calorifier water heater, and the complete heating circuit is closed, including the six waste heat



Sulzer Engines are installed in Europe's largest Diesel station situated at Kubel, Switzerland, and controlled by the St. Gallen-Appenzell Power Works.



Regardless of size and weight, this is an AVIATION DIESEL! It is one of four English-Electrics installed at the British Royal Air Force cantonment at Dhibban, Iraq. (See plant layout below.)



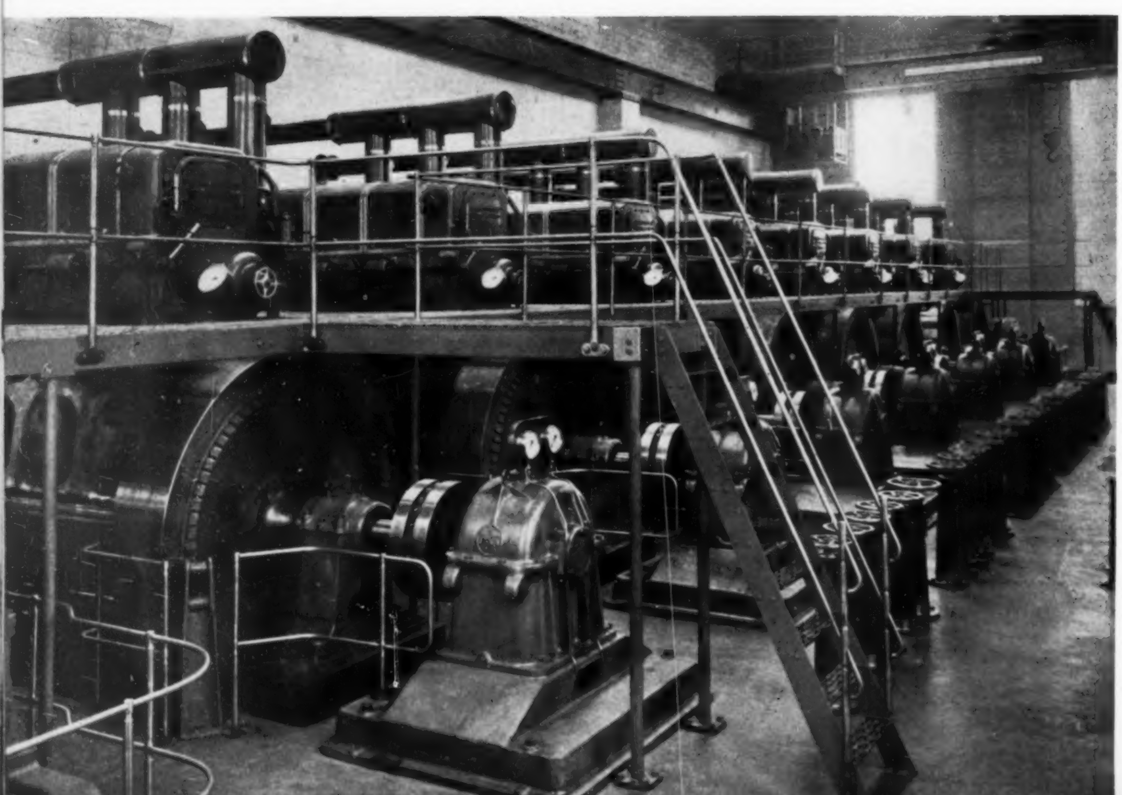
boilers, three coal-fired units, and a 6,000 gallon thermal storage tank. In an ordinary day's working it is estimated that some 45,000,000 B.Th.Us. will be recovered from these waste heat boilers, but the entire heating system can provide nearly 100,000,000 B.Th.Us. at full capacity.

The requirements of screen work call for a minimum amount of vibration and a steady torque for ripple-free and uniform-voltage generation. The horizontally opposed type of engine is best suited for this purpose, and to further insulate noise and vibration from the studios each unit is mounted independently, its concrete base blocks resting upon a 3 in. Coresil cork mat. The generators are especially designed to minimise cyclic irregularity, the figure of 1 in a 1,000 being extremely small for sets of this size. They are Mather & Platt machines supplying direct current at 230 volts pressure.

As yet the installation has not been running long enough to give any performance figures, but when they are available they should show something fairly startling in the way of economical power generation. From an appearance point of view the whole plant is most impressive, and the designers and builders can be justly proud of their handiwork.

Having dealt with Britain's largest private Diesel plant, it seems quite appropriate to deal with Europe's largest Diesel station at Kubel, Switzerland. The installation, which is of a peak load and standby character is under the control of the St. Gallen-Appenzell Power Works, in connection with whose hydro-electric station it operates. The Kubel plant is not by any means new having been in service since 1933, but its size and power should make it of interest to American readers. It consists of three Sulzer double-acting two-stroke Diesel engines, each normally developing 7,400 bhp. and coupled to a 5,000 kw. Oerlikon generator. The station has, therefore, a total output of over 22,000 bhp., or 15,000 kilowatts.

The engines occupy the whole of the available space in the station, and there is evidently no likelihood of an increase in capacity of the station. Each Diesel has eight double acting cylinders of 600 mm. bore and 1,000 mm.



Interior view of the Leatherhead Water Works, showing nine 218 bhp. Allen totally enclosed Diesels coupled to bore hole pumps and generators.

stroke, and develops 7,400 bhp. in continuous service and 8,500 bhp. at overload; the normal speed is 187 rpm. Airless fuel injection is employed and scavenging air is supplied by a reciprocating pump directly-coupled to the engine crankshaft. The three generators are of the revolving salient pole type and supply current of 50 cycles frequency at 10,700 volts. The official trials for all three engines were carried out twice, once at Winterthur on the test bed, at the Sulzer works, and a second trial in the Kubel power station. The results are given below:

Load	½	¾	1	110%	115%
Mean speed (rpm.)	187	186.5	187.5	187.3	186.9
Effective output (kw.)	2,743	4,048	5,334	5,922	6,178
Generator efficiency (pr.cent)	95.5	96.3	96.7	96.79	96.8
Power output (bhp.)	3,915	5,720	7,500	8,330	8,690
Fuel consumption (lb. pr. bhp.-hour)	.415	.384	.382	.383	.389
Scavenging air pressure (lb. pr. sq. in.)	3.97	4.19	4.42	4.56	4.63

Since its installation the plant has been working for much longer periods than at first intended, yet it has stood up to the load demands perfectly. No engine trouble of any sort has been experienced, and the cylinder wear has so far been almost negligible.

One of the most important Diesel engine contracts placed in this country last year was for the power house of the Royal Air Force contonment at Dhibban, Iraq. Situated on a sandy, arid plain where temperatures at times reach 125 degrees F. and dust storms are prevalent, the Diesels are called upon to give extremely arduous service. As regards dust storms, special precautions have had to be taken, and housed in a separate building is an electrically-driven Heenan and Froude air-filtration plant capable of delivering to the station 15,000 cub. ft. of clean air per minute.

Four English Electric Diesel alternator sets of 875 bhp. each are used for power generation and supply all the requirements of lighting, heating, cooking, ice-making, water supply and sewage-disposal services. The engines are

10,000 Diesel horsepower at the Mogden Works of the West Middlesex Drainage Scheme. Seventeen Harland & Wolff, Ltd., Diesel engines are installed, six in the Pumping Plant and eleven in the Compressor House. The centrifugal blowers in the background (below) are driven through Vulcan Hydraulic couplings.

seven cylinder four stroke airless-injection units, having cylinder dimensions of 15 in. bore and 20 in. stroke, and develop their normal output at 375 rpm. Each engine is directly-coupled to an alternator and attached exciter of English Electric make. Because of the exceptionally difficult operating conditions each set is de-rated down to 470 kw., 50 cycles, 6,600 volts pressure; the normal output would be 605 kw.

The accompanying diagram shows a plan of the station, the test figures of one of the engines also being given.

Incidentally acknowledgment must be made to the British Air Ministry, from whom these particulars were obtained for publication.

Load	½	¾	1	125%	140%
Effective output (kw.)	235.2	346.3	471.2	599.4	670
Generator eff. (pr. cent)	93.9	95.2	95.5	95.7	93
Power output (bhp.)	335.8	487.8	661	839.5	968
Fuel consumption (lb. pr. bhp.-hour)	.406	.373	.362	.367	.361

Another aspect of power generation for which Diesels are used extensively is for pumping and drainage systems. Of the former type of installation the Leatherhead plant of the East Surrey Water Co. is a notable example.

The first impression one receives on entering the pumping station is one of neatness and simplicity, for there are no fewer than nine similar engines in a row in a lofty and naturally well-lighted building, and there is a creditable lack of pipework and auxiliaries about the building. Two engines, one at each end, drive generators, two more drive borehole pumps, and the remaining five are driving force pumps, all the pumps being installed in the basement and the drives transmitted through bevel gears. The borehole pumps are designed to deal with 3 million gallons per day from a depth of 60 ft. below surface and against an external head of 132 ft., whilst the force pumps are capable of achieving two million gallons per day against a total head of 265 ft. when they are working in parallel, and half this quantity in series operation at double the head.

The engines are of the latest Allen totally-enclosed four-stroke airless injection type with open combustion chambers and C.A.V.-Bosch injection equipment. They are of the high camshaft type in which the valves are operated directly from the camshaft through push-rods and rockers. Each cylinder has its own injection pump located immediately above the camshaft, from which it is actuated, and hence the fuel leads to the automatic type fuel injection valves are short and of equal length. Each engine is rated at 218 bhp. at 285 rpm. in three cylinders 350 mm. in diameter by 470 mm. stroke.

Also installed in the station are two 110 bhp. motor-driven force pumps, and these, together with numerous auxiliary pumps, electric motors, central gear, main switchboard, pumps and generators were all designed and constructed by W. H. Allen Sons & Co. Ltd., of Bedford.

The Mogden Works of the West Middlesex Main Drainage scheme is one of the largest and most up-to-date of its kind in existence, designed to serve a population of one and a quarter million people, and costing some 27½ million dollars.

The plant includes 17 power units, all of which have been supplied by Messrs. Harland and Wolff Ltd., having an aggregate capacity of about 10,000 bhp. Six of these units each developing 500 bhp. at 300 rpm. are Diesel engines of the 6-cylinder, 4-stroke trunk type working on the airless injection principle and having cylinders 330 mm. in diameter by 580 mm. stroke. These engines are coupled by means of bevel gearing and about 50 feet of vertical shafting to low level storm water pumps supplied by the Worthington-Simpson Company, their purpose being to raise the sewage from a low to a high level.

In order to avoid trouble with torsional resonance in such a shafting system, which in certain previous installations has been known to give trouble principally in connection with the gearwheel teeth, an elaborate investigation was carried out by the engine builders on whom the responsibility was laid for the satisfactory operation of the whole system. The shafting system includes the use of flexible spring couplings and a heavy flywheel is interposed between each engine and the bevel gear box drive. Apart from minor features, these engines are duplicates of the fifteen engines supplied by Messrs. Harland & Wolff Ltd., to the Iraq Pipe Line.

In a separate building, the compressor and generator house, are to be found ten units of the same general type, but capable of working either as Diesel or gas engines, each having 6 cylinders 400 mm. diameter by 600 mm. stroke, developing 650 bhp. on a very easy rating at 300 rpm. when working as oil engines and 550 bhp. when working as gas engines on Methane gas, which is a by-product of the sludge disposal process. Six of these engines are coupled to 3-stage centrifugal blowers through the medium of Vulcan hydraulic couplings and double helical increasing gears. The speed of these units can be varied in service from 200 rpm. to 330 rpm., the governor being variable over this range.

Careful torsiograph tests carried out on the site showed that the use of hydraulic couplings between the engines and the gearing had had the desired effect of preventing the transmission of any appreciable fluctuation of torque, so that the running of the gearing and of the blowers is extremely steady.

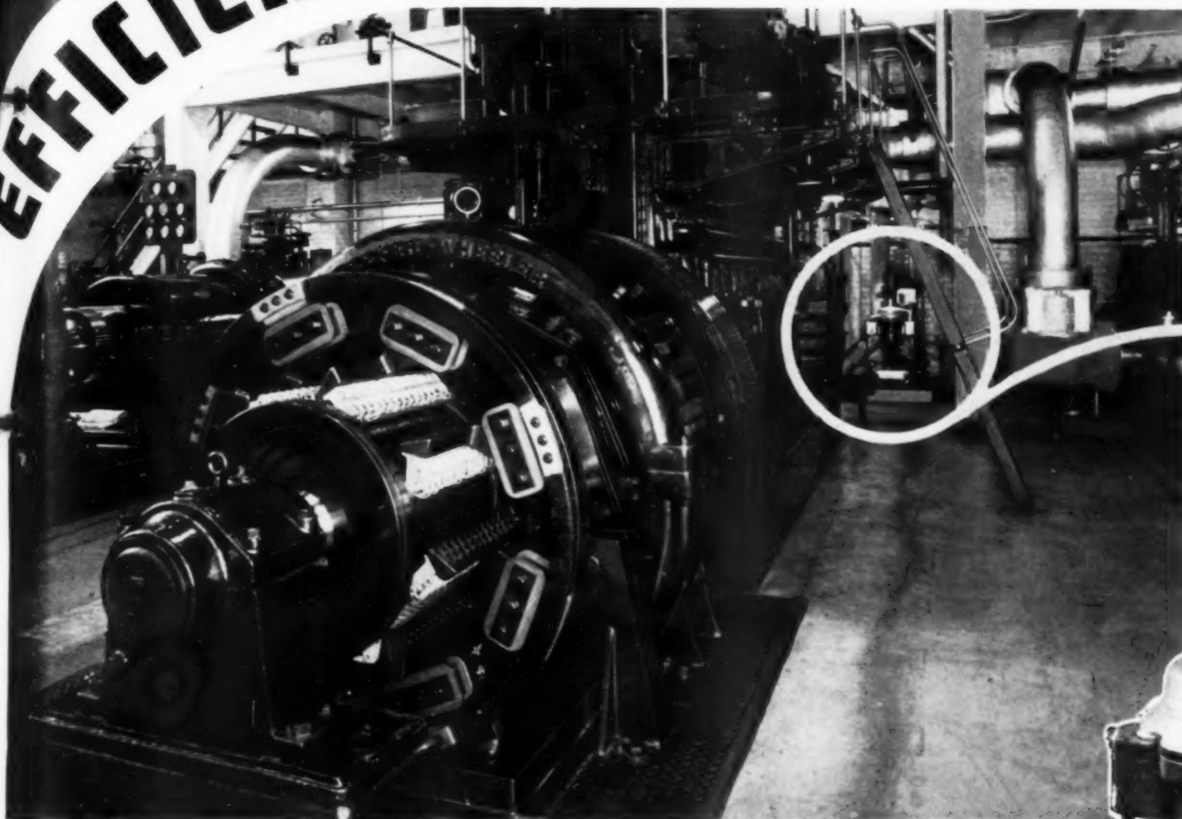
The four other sets of the same size drive D.C. generators at a constant speed of 300 rpm. The 17th engine is a 3-cylinder unit coupled to an auxiliary dynamo for emergency lighting, the cylinder size in this case being the same as that of the pumping units first described.

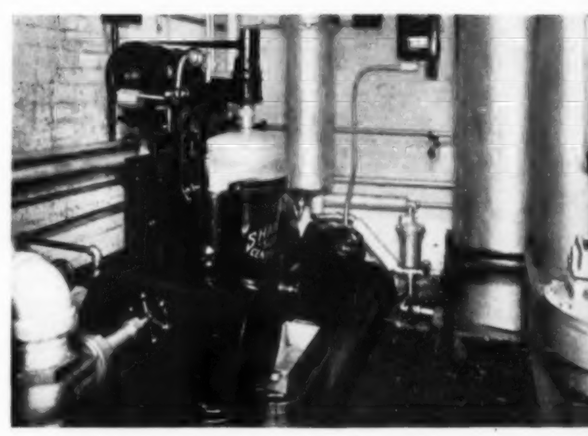
Each of the compressor and generator house engines – 6 out of 10 of which are at present running on Methane gas – has its exhaust led to a waste heat boiler for the recovery of heat, which is used in the form of hot water in the Sludge Digestion Process.

All the power units are of the Makers' totally-enclosed forced-lubricated monobloc type with enclosed forced lubricated camshafts and with the valve gear enclosed by easily romovable covers provided with glass sight holes, which can be opened by releasing a thumb screw. The pistons of the larger size of engine, i.e., the convertible engines, are oil-cooled in accordance with the Makers' practice for this size of unit. The pistons of the smaller size of engine are of single piece design without fluid cooling.

CLETRAC INTRODUCES STREAMLINED TRACTORS

IN sharp contrast to the Hercules Diesel powered Cletrac illustrated on page 17 of this issue, the Cleveland Tractor Company announce a new streamlined design of the Cletrac Crawler Tractors which eliminates sharp corners and projections and sets a new style for this type of equipment. Despite the graceful beauty of these units they have the same sturdy ability to endure that has characterized Cletrac for the past twenty years. A detailed new descriptive booklet will be sent upon request to the Editor.





PARKE DAVIS, DETROIT

. . . *Continued from page 21* . . .

engine connections to avoid vibration transmission.

Fuel is stored in two steel storage tanks buried underground in the adjacent courtyard. These tanks are encased in 6" of reenforced concrete and the tops of the tanks are 3 feet below the top of the pavement. Fuel is delivered in tank cars spotted on a siding about 70 feet distant, and the fuel is unloaded by a motor driven centrifugal pump through a pipe line. Tanks are provided with distant reading gauges for showing their contents.

Fuel is withdrawn from either tank through steam heaters immersed in the fuel, and thence through a coil heater. Both heaters are under thermostatic control, and either or both of them are used as conditions require. The fuel is pumped by means of a motor driven rotary pump with a suction lift. This prevents any leakage when the pump is not in operation, as might occur were the pump suction flooded.

After being heated to the proper temperature for thorough centrifuging, the fuel passes through a Sharples centrifuge and is then pumped through a meter up to the 250 gallon day tank located on the mezzanine gallery of the engine room. In addition to the normal pumping arrangements just described, there is an auxiliary Viking rotary transfer pump for delivering to the day tank from the storage tanks.

From the day tank, the fuel flows by gravity through a strainer to a booster pump which forces the fuel through a Cuno filter under 40 lbs. pressure, and thence to the injection pumps on the engine. The well known Hesselman fuel injection system is used on this engine. Each cylinder has its own injection pump, cam driven from a pump shaft gear driven from the crankshaft. The quantity of fuel delivered to the cylinder varies with the load and is determined by the opening of a spill valve which is under the control of a Woodward governor. Fuel is delivered through a cartridge type filter and injected into the cylinder in which the air has been compressed to 480 lbs. pressure, at a pressure of 4,200 lbs. through orifices in the fuel nozzles of 0.015" diameter.

Lubricating oil is drawn from the 200 gallon rest tank, located at one side of the engine foundation, by an engine driven rotary pump, and is discharged through a cooler into the header in the crankcase. From the latter, it

passes through pipes and ducts to all of the engine bearings. All bearings are under forced feed lubrication except the rocker arms which actuate the inlet and exhaust valves. From the bearings, the oil drains back to the crankcase, and thence to the rest tank. A forced feed sight lubricator, driven from the valve camshaft, supplies small quantities of fresh lubricating oil through the cylinder walls to the pistons. The same grade of oil is used for both the cylinders and the bearings. At all times while the engine is running, oil is constantly being withdrawn from the rest tank through a steam heater, under thermostatic control, through a strainer, to a Sharples centrifuge for purification. The clean oil is returned to the rest tank.

Cylinders, exhaust valve cages, and fuel injection valves are water jacketed. Soft water for cooling them is circulated by a motor driven centrifugal pump, which draws from the 800 gallon hot well tank and delivers through a heat exchanger and thence to the jackets. Overflow is back to the hot well. Makeup soft water feed is provided by taking water from the city mains and passing it through a small water softener. Raw water is circulated through the heat exchanger to cool the soft water.

Starting is by compressed air supplied at 240 lbs. pressure by a motor driven compressor set and stored in a steel bottle of about 60 cu. ft. capacity. Only three of the cylinders are fitted for starting air, and the starting valves in the cylinder heads are operated by timing valves which are in turn operated by cams on an extension of the injection pump shaft. For spotting the engine for starting and for turning the crankshaft during maintenance work, there is an air jack which acts on the flywheel and is operated by compressed air at 60 lbs. pressure.

The engine is provided with an Illinois Testing Laboratory pyrometer to show the temperature of the exhaust gases from each cylinder. There are thermometers showing the temperature of the incoming cooling water for the entire engine, outlet water from each cylinder and from the entire engine. Other thermometers show the temperature of the incoming and outgoing lubricating oil. Dial gauges show the pressures of the water, lubricating oil and starting air. A Barbour Stockwell tachometer is permanently attached to the engine crankshaft and shows the engine speed. There is a 7½ ton crane overhead for handling engine and generator parts.

All pumps and centrifuges are driven by individual motors and are wired to one watthour meter so that the power consumption of the auxiliaries can be known. Records indicate that the average power consumption of all of the auxiliaries is about 230 kwh. daily.

The generator has an individual volt meter, ammeter, and watthour meter on the unit switchboard panel located at the generator end of the unit.

This unit has not been in service long enough yet to justify the owners in saying much about the results, but the indications are that it will more than fulfill every expectation. Records of 12 and 13 kwh. of energy at the bus bars per gallon of fuel consumed, varying somewhat with the outdoor temperature and the load, have already been established. The unit has operated 1,500 hours continuously, but while there is no indication that this is the limit, there has not been sufficient experience to date to indicate what the limit is with safety and efficiency.

One more example of correct machinery application to provide flexibility to give balanced economy under varying operating conditions.

DIESEL SNOW CONTROL

. . . *Continued from page 24* . . .

Co. last winter used an Angledozer mounted on a 95 hp. Diesel tractor to keep a 32-mile road over a mountain pass between its mine and Sumpter clear of ice and snow so a Diesel tractor truck could haul in supplies. The Angledozer made the round trip in two days.

Using an Angledozer on a Diesel 50 tractor, Utah Construction Co., building Pineview Dam in Ogden Canyon, was able to keep roads clear so it could work all winter long.

But in snow-moving as in dirt-moving all is not excavation – sometimes there is a placement job. One of Idaho's big winter events is the Ashton Dog Derby, which requires snow track some four feet high. Fremont County has a Diesel 40 tractor with an Angledozer, which it uses for clearing roads of snow and sledging CCC workers into the mountains. This combination was turned successfully to the job of constructing the snow track for the derby.

Whether it was snow cut-and-fill or trail clearing, or carrying on construction projects through icy winds and sub-zero weather, Diesel equipment proved last winter that it was capable of delivering its best in the worst weather.

DIESELS IN ITALY

. . . *Continued from page 46* . . .

towns. If you take, for example, the Bologna-Venice railway running on level stretches you find that steam express trains employ 2 hours and 36 minutes while Diesel driven rail cars undertake the same trip in 1 hour and 43 minutes. On the other hand, on the Ancona-Roma line, which reaches about 400 meters above sea level, the Diesel rail car employs 4 hours against 6 hours employed by the steam trains. Furthermore, on the Milan-Venice line, the Diesel rail car undertakes the trip in 2 hours 40 minutes as pointed out, whereas the Simplon-Orient-Express undertakes the trip in 3 hours 30 minutes, and it is particularly in this case that it is possible to see what the Italian State Railways Administration can spare by the employment of the Diesel traction as the Simplon may be compared to the old steam express trains consisting of a steam locomotive, a baggage car, and two first and second class cars. If you take only the personnel expenses you can notice that while in the steam express train you had, excluding the kitchen personnel, at least five persons, in the Diesel driven cars you have only two persons.

2210 KW. DIESEL FACTORY

. . . *Continued from page 39* . . .

of doors. Thus, when the main units are shut down and the load is being carried by this small unit, it is as though the power were being furnished by an independent self-contained station. This gives flexibility and economical operation.

The Foster-Wheeler waste heat boilers are of the 125 lb. type and the steam generated by them, when the main units are running, is delivered into the high pressure process steam piping system.

The starting air is supplied by either the motor driven or the Wisconsin gasoline engine driven Quincy air compressor. The air is stored in six air tanks located on the mezzanine floor.

At the operating end of each engine, within view of oil and water thermometers and all engine operating instruments and gauges, is located a self-supporting stainless steel shelf for the engine log sheets, above which, on an extended standard, is mounted the Alnor exhaust pyrometer and switch for measuring the temperature of the exhaust for each cylinder. All electrical cables from switchboard to the mill proper are run in an underground conduit from the northeast corner of the power house, while the steam, air and other pipes are carried in a tunnel from the southeast corner to the mill.

All engine piping, except the intake and exhaust headers and cooling water returns, which are overhead, is placed in pipe trenches under the floor. The fuel oil supply to the day tanks and the steam and feed water piping for waste heat boilers is overhead in the auxiliary bay.

The soil at the site of this plant is a variegated clay, having colors from light to dark and having a low specific gravity, but getting denser as depth is attained. Most of it is subject to considerable change in the presence of water. The engine foundations are mass concrete, well reinforced, resting on this material. Particular care was taken to proportion the foundation footings so as to give practically uniform loads on the soil, considering both static and dynamic forces. No excavation for the engine foundations was done until the power house was roofed tight, so as to avoid any chance of water collecting in the trenches.

The plant is just starting into regular service, and final adjustments have not been made. It is too early, therefore, to discuss operating and performance features. The whole plant has been laid out to operate with a minimum of effort and attendance.

EXCESSIVE PISTON HEATING, CAUSE AND EFFECT

By B. J. VON BONGART

THE pistons of Diesel engines must withstand higher temperatures than the pistons of spark-ignited internal combustion engines, and they are also called upon to dissipate successfully the greater heat. The high compression ratios of Diesel engines, needed for auto-ignition, are the direct cause of the higher temperatures reached, but these high temperatures due first to compression and then to combustion are not in themselves the cause of excessive piston heating. In order to make this clear, a few typical Diesel-engine combustion chambers selected at random will be analyzed in detail.

The valve-in-head construction is well nigh universal for Diesel engines, but the constructional details and variations of the combustion chamber designs run the whole gamut of open-, ante-, turbulence-, air-, energy-, by-, after- and companion chambers, and for each of these certain virtues are claimed that the other constructions are said not to possess. That some constructions are based upon sound, painstaking research is certain: that others are merely inventor's fancies is equally certain. It would go too far beyond the scope set for this article to completely review the multitude of chamber constructions in vogue in Diesel-engine practice and their possible effects upon the piston-head. In Figs. 1 and 2 two typical "open chamber" designs are shown.

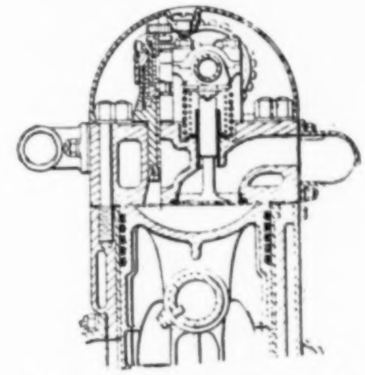


Fig. 1. Open chamber Diesel engine.

As will be noticed, the fuel-injection nozzle is located in the cylinder head between the valves, directing the fuel stream against the piston-head. In Fig. 2, on the other hand, the fuel nozzle is located on the side of the cylinder: hence the fuel-stream enters the combustion chamber horizontally and thus does not strike the piston-head* directly.

*See "The Phenomena of Diesel Engine Ignition and Combustion" in the October issue of DIESEL PROGRESS.

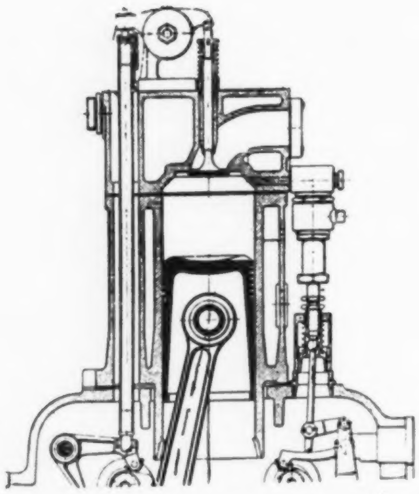


Fig. 2. Open chamber Diesel engine.

Many designers of Diesel engines claim that in open-chamber engines no intimate mixing of the fuel and air charge can take place; hence they provide an auxiliary chamber in which part of the combustion takes place, and the final combustion and expansion occurs within the space above the piston. A representative ante-chamber is depicted in Fig. 3.

In the type of construction shown here, the

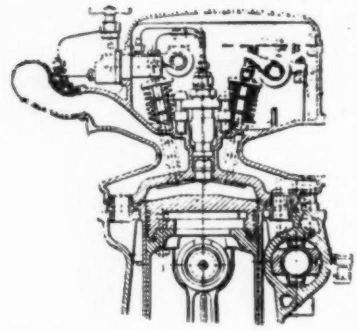


Fig. 3. Ante-chamber Diesel engine.

air charge is divided into two parts, one contained within the ante-chamber and the other within the combustion chamber proper (the space just above the piston). The fuel is injected vertically into the ante-chamber, but it will also enter the combustion chamber proper through the orifice or channel connecting the former with the combustion chamber proper.

A variation of ante-chamber, commonly known as a turbulence chamber, since its spherical form creates a turbulence, is shown in Fig. 4.

In this type of construction, the entire air charge (except for the clearance space needed between the piston and cylinder head) is con-

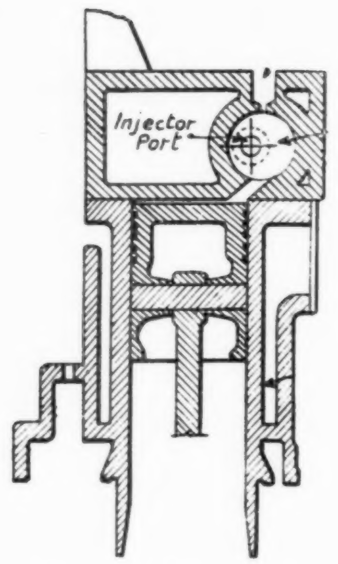


Fig. 4. Turbulence chamber.

tained within the said turbo-chamber, in which combustion then takes place. Thus the piston is subjected only to the expansive force of the combustion within the turbulence chamber.

The generating of heat — aside from transforming the said heat into mechanical energy — is the sole and only purpose of all internal combustion engines, since the heat generated is the source of the power developed by such engines. But in order to protect the piston head from excessive heat waves and thus from early destruction, the flame propagation should be controlled and the piston should be subjected only to the expansive force of the heat waves and not to any actual flames of excessive temperature.

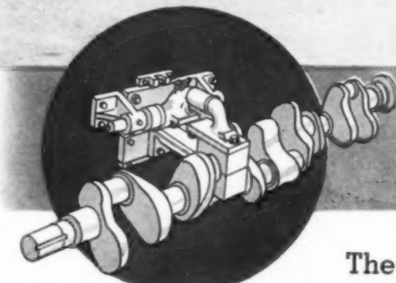
When we analyze the fuel injection, as in Fig. 1, we find that the vertically downward fuel injection towards the piston head is equivalent to the action of bunsen-burner; i.e., a flame is directed against the head of the piston, heating the latter's area excessively at one spot and less so for the remainder of its surface, since the greater portion of the piston head is subjected to the general heat of the flame propagation alone, rather than to the excessively high heat concentrated within the point of the flame.

In Fig. 2, where the fuel injection is in a horizontal plane and directed across the open-chamber, the piston head is subjected only to the heat waves of the flame propagation and combustion.

The ante-chamber as depicted in Fig. 3 has a compound effect upon the piston head; i.e., the fuel stream is not in its entirety absorbed by

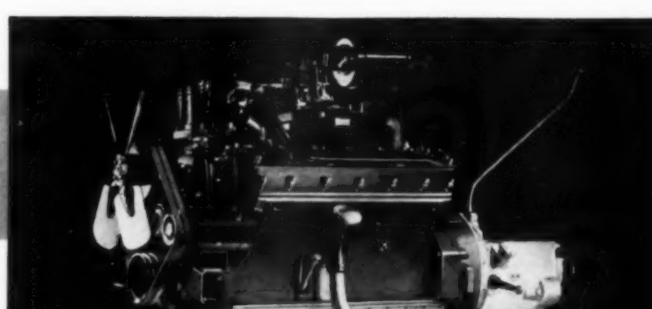
. . . . *And now please turn to page 58*

1937 PACKARD TWELVE HAS TOCCO-HARDENED CRANKSHAFT



The advanced 1937 Packard Twelve—one of the world's leading automobiles—is mechanically far ahead of any car that has ever borne that distinguished name. Its V-12 engine, like the new 1937 Packard Super-Eight, has a TOCCO-hardened crankshaft—a superlative endorsement of the TOCCO PROCESS.

The Packard Motor Car Company has adopted TOCCO-hardened crankshafts for the engines of its finest 1937 cars—the Packard Twelve and the Packard Super-Eight. These new, deluxe cars, listing at the factory from $2,335 to $3,420 and up, represent the last word in Packard's experienced engineering—the best cars that money can buy! In them nothing has been overlooked which will help give "the Man Who Owns One" a superlative measure of luxurious transportation, long, trouble-free engine life and economical service. Packard engineers say that the TOCCO-hardened crankshafts in these fine passenger-car engines will give Packard owners not only longer-lived bearings but more efficient operation and lower oil and other maintenance costs. Undoubtedly Packard, which has pioneered so many engineering advances, is but the first of a long list of passenger-car manufacturers who by adopting TOCCO-hardened crankshafts will give their owners improved engines, smoother power and lowered costs.



A MASTERPIECE OF ENGINEERING

The Packard Twelve-cylinder engine is looked upon as one of the world's leading power plants. All Packard Twelve and Super-Eight engines now have TOCCO-hardened shafts.

"TOCCO-HARDENED CRANKSHAFTS TO SAVE ENGINE USERS MILLIONS"

Metallurgists and engineers who watched the commercial TOCCO-hardening of crankshafts at the recent Cleveland Metal Show estimated that the adoption of the process by engine manufacturers would mean the saving of millions of dollars to the operators of trucks, buses, agricultural and industrial machinery and passenger cars. These savings, they said, will result, first, from lower cost of manufacture—through the elimination of expensive alloy steels and the cutting down of machining time as well as heat-treating time and expense and, second, from important economies in maintenance expense, lower oil consumption and far longer periods of uninterrupted service. At left—TOCCO hardening equipment at the Metal Show.

THE TOCCO PROCESS of surface-hardening by electrical induction produces an exact result. Shafts can now be hardened quickly at small cost, and *at the bearing points only*—to 58-60 "C" scale Rockwell hardness (600 Brinell). This permits harder bearing metals and longer-lived engines. While the first application of the TOCCO PROCESS to be worked out and perfected for industrial use has been the hardening of crankshafts at the bearing surfaces, many manufacturers have completed tests and are about to adopt the process in hardening other important parts such as axle shafts, cam shafts, front wheel spindles, steering gear Pitman arm shafts, etc. Other applications are being developed.

AMERICA'S FOREMOST MOTOR CAR AND ENGINE MANUFACTURERS HAVE ADOPTED THE

TOCCO PROCESS

The TOCCO PROCESS saves money for both the engine manufacturer and the engine operator. It has already been adopted by such leading manufacturers as the Autocar Company, the Cummins Engine Company, the General Motors Corporation, the Hercules Motors Corporation, the International Harvester Company, the Packard Motor Car Company, the Waukesha Motor Company, the White Motor Company and many others. Purchasers and operators of engines or equipment made by these outstanding companies may safely anticipate important savings in maintenance and operating costs.

THE OHIO CRANKSHAFT CO. *Cleveland, Ohio*

LETTERS

Dear Mr. Wadman:

My Company mailed me copy of your DIESEL APPLICATION PLAN BOOK receiving it about ten days ago. I have gone over every page of same, and consider it very valuable in every way.

I have been looking for a book of this type for the past 20 years, that I have sold Diesel engines, just the other day I got out this book and the prospect and I went over many types of installations. I could not have gotten this man so much interested any other way I am sure. This book will be in my brief case daily from now on.

You have contributed to the Diesel industry a much needed instrument, and should be congratulated by all manufacturers and salesmen of Diesel engines.

M. D. CULP,
Buckeye Machine Co., St. Charles, Mo.

* * * *

Dear Mr. Wadman:

Our attention has just been called to your Diesel Application Plan Book 1936 by one of our local Diesel engine salesmen, and we note with interest the plan contained in this book, No. 179, which covers the application of Diesel engine in a flour mill. We would appreciate it you would advise us at once who we can get in touch with to get more specific information concerning this installation and who you would recommend that we get in touch with who would be familiar enough with this job to be of assistance to us in our mill for similar installation.

Your prompt reply to the above request will be greatly appreciated.

R. L. ROBERTS,
Dallas, Texas.

* * * *

Dear Mr. Wadman:

To the host of bouquets which should now be flowing in from those who have received your PLANBOOK, may be add our congratulations to you for a beautiful job.

We like the concept — and the effective style in which the applications have been illustrated and described, the format, the modern binding — and everything.

Today's thinking embraces the Diesel engine, and we believe you have presented this modern product with commensurate modern feeling.

PAUL W. AUSTIN,
Owens, Illinois Glass Co., Toledo, O.

* * * *

Dear Mr. Wadman:

Your Plan Book has been received and I am greatly impressed with it. I am reading it in my spare moments at the present time and find it a splendid publication and one which I believe will stimulate much new business for the Diesel Engine manufacturers.

I know that such a book as this will be of great interest to our clients and I am going to utilize it in my sales efforts to illustrate the various types of Diesel Engine application to municipal and industrial power situations, so you see it has a very large workable possibility in furthering my own efforts to secure additional business for our own organization.

R. H. McDONNELL,
Burns & McDonnell Engineering Co.,
Kansas City, Mo.

EXCESSIVE PISTON HEATING

. . . . *Continued from page 56* . . . .

the air charge within the ante-chamber, hence part of the fuel enters the combustion chamber proper and ignites there. This then acts like a bunsen-flame upon the piston, and when the fuel retained within the ante-chamber ignites, a flaming mass emanates from the ante-chamber, striking the piston head in blow-torch fashion. In some ante-chamber constructions the initial ignition takes place within the said chamber and the flame propagation progresses towards the combustion chamber proper. In others, the ignition occurs in the combustion chamber proper and the flame propagation eating its way into the ante-chamber. In such cases, an ante-chamber is a useless encumbrance.

Analyzing the action of the turbulence chamber (Fig. 4), it becomes clear that since practically all of the air charge is contained within this chamber, and since the fuel is injected by the nozzle in a horizontal plane, no appreciable fuel dribbling can enter the minute space above the piston (while the latter is near T.D.C.) during the injection of the fuel. As and when ignition sets in within the turbo-chamber, a stream of burning fuel-air leaves the chamber and enters through the comparatively narrow passage into the space provided by virtue of the downward movement of the piston, and this flame of fire acts upon the piston head like a blow-torch.

As previously said, pistons are intended and expected to withstand the heat generated within an engine's combustion chamber, but such heat should only be the mean temperature of the propagating flame, not the excessively high temperature of a bunsen-type burner or that of a blow-torch flame which would have a tendency to scorch a small area of the piston head.

True, only pistons of less than 12 inches in diameter are expected to dissipate the heat by means of the rings and by coming into contact with the surrounding water-cooled cylinder. All large engines are provided with oil- or water-cooled pistons, but even if cooling by external means is assured, it should not be necessary for the cooling medium to absorb the extra localized heat caused by the method of fuel injection or the action of a particular chamber construction, or both.

One school of Diesel technicians recognizes the detrimental effects of localized heat upon the piston by either providing extra heavy pistons so that a large mass may absorb the excessive heat (this makes high engine speeds impossible) or by making use of special built-up pistons; i.e., pistons with an iron skirt and a forged-steel head. Both are poor solutions in that they are attempts to cure the effect rather than the cause.

Fig. 5. Twin blow-torch effect upon piston head.

It has for some time been customary to investigate the heat waves to which the piston is subjected. This is usually done by drilling small holes into the piston head and then plugging these holes with a substance known to melt at a given temperature. By judiciously placing such tell-tales all over the piston head, a fair idea of the actual temperatures existing at the piston head may readily be gleaned. However, such procedure is cumbersome and time-robbing, and, if metal is used for the plugs, there is a possibility that such molten plugs may leave the holes into which they were inserted and place themselves between

the piston and cylinder head with perhaps disastrous results.

A novel method of recording the effects of waves of excessive heat is by means of photography, as shown in Fig. 5.

For this test, the engine was run for a considerable time. Then the pistons were extracted, and their heads chemically treated and photographed so as to bring out the effects of the uneven heat waves as they had struck the piston head, causing excessive heating at certain spots and much less heating in others.

The engine in question featured an antechamber having two outlets or connecting channels towards the piston, the shaded portions of the photograph showing clearly what has taken place. The fuel nozzle was so placed that no part of the fuel itself could reach the piston head; hence what the picture shows is a dual blow-torch effect.

This twin-outlet ante-chamber construction was an attempt to reduce the "blow torch" effect, whereas it actually made matters worse in that it caused two "hot spots" instead of but one.

The great majority of Diesel engines feature a separate chamber of one sort or another, and much ingenuity has been expended in perfecting chambers that would give unfailing auto-ignition and a minimum of ignition lag. Much has been done in this respect that is commendable, but the next logical step is to investigate the actions of the heat waves caused by the flame formation and propagation, and then to provide chambers of such form and so positioned as to cause the least number of uneven heat waves, and to prevent direct flames of excessive heat from ever reaching the piston head. And once the Diesel fraternity has obtained positive proof of the effects of a given flame propagation and combustion, it will not require great ingenuity to eliminate the cause.

The future development of Diesel engines, in so far as flame propagation and controlled combustion is concerned, will certainly be guided by such unmistakable data as is furnished by photography.

The invaluable information thus obtained as to the behavior of the combustible charge within an engine's cylinder will inevitably lead to designs making piston failures or fractures a thing of the past, and in addition will lower the fuel consumption of Diesel engines for the reason that better, more complete and more rational combustion will invariably result from superior engine designs.

CAMERON, MISSOURI

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There has never been a service charge and the Federal tax is absorbed by the plant and not charged to the patrons. Minimum charge is 75c per month for resident patrons. Motors of 5 hp. and above call for a minimum of $1, with 50c per hp. additional over that amount. Shutdowns are practically unknown. In the old steam plant days there were many and the time was indefinite. In the twelve years of operation the Diesel shutdown has been something like a total of two hours. Last year one shutdown of about ten minutes occurred, and so far this year none has happened.

The plant has operated beyond the hopes of those who sponsored its inauguration and is now in excellent condition. Improvements over the twelve years have put it in a class not excelled by any of this section. In 1924 the plant started with a capacity of 800 hp. and today that hp. is 2,050. Then, there was no standby machine, but now the capacity is ample, since the peak load averages 520 kwh.

In addition to the city service, farm lines are now running out in all directions for several miles, impossible under the limited capacity of the old plant. The plant has always operated the pumps for the city's water system.

The new structure is located at the edge of the city away from the business and resident section. It is a red brick building, 50 by 85 feet, with concrete slab roof. The yard has been planted with shrubs, trees, and grass and is kept in very attractive condition. Cameron is well satisfied indeed with its Diesel investment.

NORDBERG ANNOUNCE BURMEISTER WAIN LICENSE

IN acquiring the license for building Burmeister & Wain two-cycle Diesel engines in America, Nordberg Manufacturing Company of Milwaukee has further increased its already extensive line of engines of the two-cycle type. Burmeister & Wain designs are now available in both single and double acting types for stationary and marine service. This arrangement combines the vast experience of Europe's foremost builder of marine Diesels with the engineering and manufacturing facilities of Nordberg who for years has specialized in the building of large units for the American trade.

For the past several months, Emil Grieshaber, Chief Engineer, and Rudolph Wintzer, Consulting Engineer, of Nordberg, have been in Copenhagen becoming familiar with the design, construction and operation of Burmeister & Wam engines, together with the manufacturing practices of that company.

SAUERER DIESEL CAR

NEW YORK CITY was recently all stirred up, at least the crowds seemed to attest to that fact. A new Diesel automobile was seen around town.

It appears that the Saurer Diesel Company of Switzerland has designs on the American market and sent a Diesel equipped car over to demonstrate the feasibility of the Diesel for passenger car service.

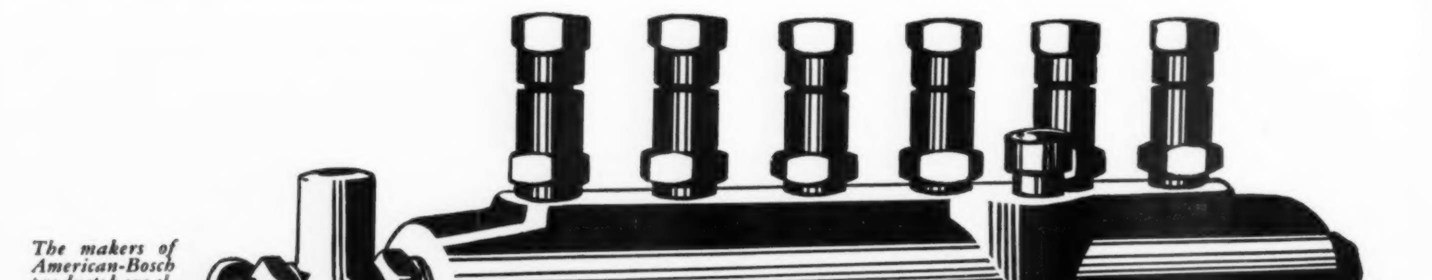
The demonstrating car is a standard Dodge model, built in one of the European Chrysler plants and powered with a standard six cylinder, dual valve, Saurer Diesel engine, a duplicate of the engine used in so many automotive installations abroad.

Mr. E. B. Wakefield, who represents the Saurer people over here, claims this car will run 39 miles on ONE gallon of No. 3 Diesel fuel, costing 6½ cents, that the water glass held in the hands of demonstrator in the illustration above, containing 8 ounces of Diesel fuel, costing 4/10ths of a cent, will drive the Saurer automobile 2½ miles. The same amount of gasoline is said to only drive the average car about thirty-eight hundred feet.

The Saurer Demonstrator is scheduled to make a trip across the continent to San Francisco, following the same route traversed by the pioneer Saurer truck in 1911, which is claimed to be the first truck to carry freight from New York to the Pacific Coast.

The Diesel automobile is very much in the public's mind, no doubt about that, but there is a long road to follow before a Diesel automobile becomes practical for the average man's pocket book.

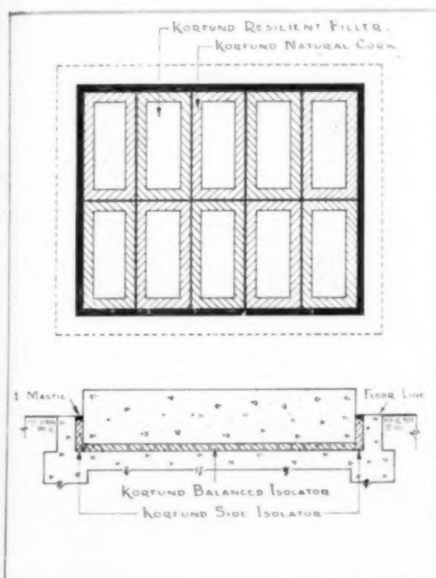
Little matters of quietness, flexibility, weight AND manufacturing cost yet remained to be worked out, but this Saurer equipped Diesel automobile is a step in the right direction – it is pointing the way.



NATURAL CORK FOR VIBRATION CONTROL

By S. ROSENZWEIG,

To make the vibratory force transmitted to the foundation as small as possible, the forced frequency of the operating machine must be large compared to the natural frequency of the vibration absorber. This ratio should be at least 3 to 1 – and in many cases considerably more – depending upon local conditions. For any specific machine operating under a given set of conditions the normal operating speed and hence its resulting forced frequency is fixed. Therefore, greater ratios between forced and natural frequencies are obtainable only by



reducing the natural frequency of the isolating medium. Small natural frequencies and hence great ratios between forced and natural frequency and, therefore, lower transmitting effects are only obtainable with well designed vibration absorbers. Achieving a greater decrease in natural frequency requires careful design and a thorough understanding of the laws of vibration isolation.

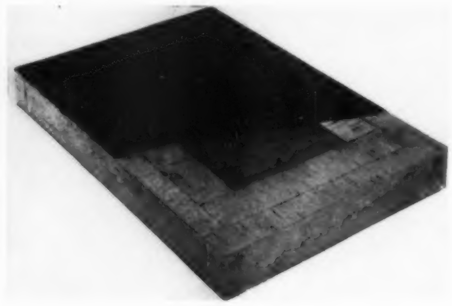
In organic materials the correct frequency is brought about by loading them correctly, and it is usually good practice to load them to a safe maximum within the elastic limit. Cork 1 in. thick, for instance, has a natural frequency of 74 cycles per second under a load of 1 lb. per sq. inch and 18 cycles when it is 100 lbs. per sq. inch. The same results are obtainable by varying the thickness of the materials. If the thickness is increased to 6 in. the corresponding frequencies will drop to approximately 30 and 7, respectively. It is this frequency which controls the efficiency of the isolating medium for the absorption of periodic vibrations. It displays ignorance of the principles involved to state, as some do, that a thick cork mat is needed to isolate intense vibrations. They may be safely absorbed by a 1 in. thick mat, while under other conditions for a lesser force a much greater thickness may be required.

Natural cork has proved to be one of the most useful of all materials for the isolation of impact vibrations. It has structural strength sufficient to support loads far in excess of the recommended maximum. It has a low modulus of elasticity and such resiliency that it can, if properly applied and correctly loaded, effectively isolate a wide range of machinery, if the operating frequency is not excessively low. It possesses elasticity of volume to a very marked degree. It may be compressed to a fraction of its original volume and yet return nearly to its original shape after the pressure has been re-

. . . . . *And now please turn to page 62*

moved. It has a definite time lag in its expansion after compression, which prevents a pulsating or bounding action in the machine which it supports. Oil and water have no effect other than to preserve the natural resiliency of the cork. Frequent installations have been made where natural cork has been totally immersed in oil for a period of years. Under the most severe conditions of installation, natural cork will outlast many times the machine which it is isolating.

There are many cases where a *solid* mat of natural cork is unsatisfactory for efficient isolation because the loading per square foot is too low. In other installations there is a marked unevenness in the weight distribution, requiring a special arrangement of the supporting cork surface. One method of meeting such loading requirements has been to insert under the machine base or foundation strips of natural cork alternated with strips of a low density filler. Such an arrangement has often resulted in an uneven settling of the machine base. To solve these problems engineers have designed a special cork plate (Korfund Balanced Isolator). These plates consist of frames of natural cork strips interspaced with a resilient filler of low density. All such plates are made to suit any predetermined loading by increasing or diminishing the width of the cork frame and so varying the cork area of the plate. In this way installations involving light loadings or unevenly distributed loads can be efficiently isolated. The filler provides an even surface for concrete foundations and also acts as a spacer for the natural cork frame.

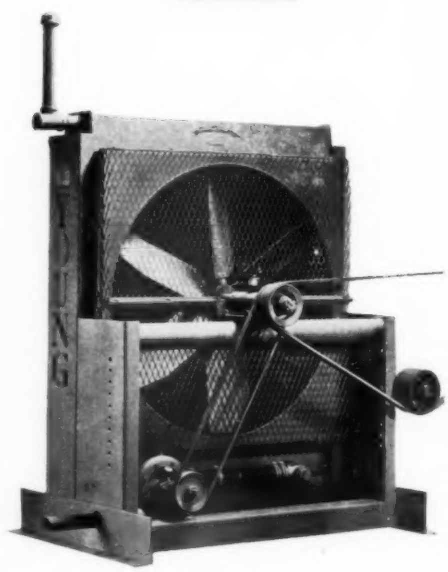


Natural cork frame and filler are assembled in a single unit, the top and bottom of which is bound with asphalt and asphalt felt. They are assembled on the foundation in accordance with setting plans furnished by the manufacturer. By sealing the joints a water tight surface is provided ready for pouring the concrete.

When installing these plates under a concrete foundation, it is recommended that concrete be poured first to a thickness of 4 in. to 6 in. After this concrete has hardened, more concrete is poured to complete the foundation block. In this manner the load is safely concentrated on the natural cork area.

Manufacturers' recommendations should be obtained as to permissible loadings and thickness of cork for any specific installation.

YOUNG JACKET WATER COOLERS



THESE units have been designed to provide a recirculating cooling system to operate with gasoline or Diesel engines either stationary or portable. They are complete in every detail including cooling core, fan, drive sheaves, pump, idler, and bearings. Units are available in eight sizes to cool engines of 29 to 122 hp.

A new catalog illustrating and giving mechanical details and capacities of these units is available on request to the Editor.

DIESEL PROGRESS

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